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ORGANIZATIONAL EFFECTIVENESS: DEVELOPMENT  
AND VALIDATION OF INTEGRATED MODELS

REPORT II:

EMPIRICAL STUDIES OF ORGANIZATIONAL EFFECTIVENESS  
USING MULTIVARIATE MODELS

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) This report is in three parts, each summarizing an empirical investigation concerning the relationships among criteria of organizational effectiveness. The first, "Problem Solving Adequacy in Organizational Subunits," tests hypotheses concerning the role of "appropriate structure" (four aspects) and of "problem solving adequacy" (nine problem domains) to the rated performance effectiveness of hospital subunits. The second, "Organizational Effectiveness in a Retail Brokerage Firm," employs factorial analysis methods (49 objective		

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performance variables, 160 brokerage offices) to ascertain the dimensions of office performance and the compatibility of interpretations derived from alternative models of organizational effectiveness. The third, "Technology and Organizational Effectiveness," examines the joint and independent effects of certain technological characteristics and certain input characteristics upon the goal attainment of short-stay general hospitals.

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REPORT II: EMPIRICAL STUDIES OF ORGANIZATIONAL EFFECTIVENESS  
USING MULTIVARIATE MODELS

EXECUTIVE SUMMARY

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Requirement:

Report I of this series offers certain definitions and hypotheses to the end of integrating three models of organizational effectiveness. The requirement for this Report II is to employ existing archived data sets, as feasible, for preliminary tests of some of the crucial features of the proposed integrated models.

Procedures:

Three data sets suitable for the purpose were re-analyzed: one set derived from a prior study of a large general hospital, one from a study of 160 branch offices of a brokerage firm, and the third from a sample population of 203 general hospitals. The large general hospital data were used to test relationships among effectiveness criteria across the three model domains and to test the utility of "problem solving adequacy" as a predictor (or correlate) of overall unit performance effectiveness. The data from the brokerage firm were analyzed in a factorial design to ascertain the underlying structure of 56 objective performance variables; these goal attainment dimensions of effectiveness were then correlated with variables describing the organizational units in terms of their properties as natural system entities and decision-making systems. The data from a population of hospitals were employed to explore input and technological variations that impact upon goal attainment.

Findings:

The results for the large hospital indicate that sub-unit structural appropriateness is positively related to problem solving adequacy and that problem solving adequacy is, in turn, positively related to rated overall unit effectiveness. Problem solving adequacy mediates the relationship between structural appropriateness and overall performance effectiveness. This evidence gives some support to the idea that problem solving and decision making capabilities can be assessed and, when used in conjunction with systemic properties, have utility in estimating future overall organizational effectiveness.

Analysis of the data concerning brokerage offices produced nine interpretable factors, readily identified a primary goal (overall business volumes) with (1) intermediate goals representing a complementary set of specific types

of business, (2) instrumental goals representing appropriate resource acquisition, and (3) conditionally instrumental goals which appear to represent strategic options, with tradeoffs, about what means toward optimal volume shall be pursued. A simple additive model with undifferentiated goal attainment variables does not adequately represent the goal attainment effectiveness of these organizational units. A follow-on analysis indicates that optimal systemic properties (the natural system model) and optimal decision making practices (the information/decision model) are quite strongly associated with appropriate strategic choices and with resource acquisition but more weakly related to the primary goal of high volume; the primary goal appears to be reactive, at least in the short run, to market and environmental forces, while the performance on instrumental goals (future oriented?) seem more reactive to the systemic and decision making properties of these organizational units.

The comparative, correlational, study of a population of short-stay general hospitals showed that the input characteristics of patients (e.g. diagnostic category, age, expected length of stay, etc.) are quite strongly correlated with certain conversion process characteristics of these hospitals (e.g. capital intensity, staff mix, range of available services, etc.). Both classes of variables are associated with such goal attainment indicators as, for example, actual length of stay, death rates, and bed occupancy rates. No evidence of interactive effects between these classes of variables was found. The results are interpreted in the context of the feasibility of employing measures of compatibility among the components of the work system as an indicator of likely future goal attainment effectiveness.

#### Utilization of Findings:

This first effort at testing hypotheses concerning causal links between process performance and outcome effectiveness, using a decision process model, suggests the future utility of the model for diagnostic assessment of operational units. This confirmation of theoretically relevant processes will guide the development of measurement technology in future research, which will focus on information management, interdependence between structural elements of an organization, and decision/adaptation processes which underlie effective performance.

REPORT II: EMPIRICAL STUDIES OF ORGANIZATIONAL  
EFFECTIVENESS USING MULTIVARIATE MODELS

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## PART I

### PROBLEM-SOLVING ADEQUACY IN ORGANIZATIONAL SUBUNITS<sup>1</sup>

Robert I. Sutton and Larry H. Ford

Organizations have long been viewed as problem-solving entities. The structural-functionalists (e.g., Parsons, 1958, 1960; Parsons, Bales, & Shils, 1953) considered organizations to be mechanisms for solving various functional problems such as adaptation and goal attainment. In addition, Simon and his associates (Cyert & March, 1963; March & Simon, 1958; Simon, 1957a, 1957b) viewed organizations as problem-facing and problem-solving systems from a cognitive perspective. Thompson (1967) also described organizations as problem-solving social aggregates, most notably in his discussion of the coordination problem.

This perspective has been developed most completely in the work of Georgopoulos and his colleagues (Georgopoulos & Matejko, 1967; Georgopoulos 1970, 1972; Georgopoulos & Cooke, 1979; Cooke & Rousseau, 1980). Georgopoulos (1972) asserted that as open systems all organizations face a set of generic problems that they must solve in order to survive and, beyond that, to flourish. He also maintained that organizational effectiveness depends on the generation of prompt and proper solutions to generic problems as they arise. Moreover, Georgopoulos (1972) contended that social structures are mechanisms that organization members rely on in order to solve generic problems. Parsons (1958, 1960) also viewed organization structures as problem-solving mechanisms in his General Theory of Formal Organizations. March & Simon (1958) and Thompson (1967) both theorized that structures are the means for solving various organizational problems. Thus, there is some consensus among organizational theorists that an effective organization manages its problems through its structures.

The problem-solving perspective was used in the present study of hospital subunit effectiveness. Specifically, the version of the problem-solving framework that was tested in the present investigation was drawn from Georgopoulos and Cooke (1979). Georgopoulos and Cooke emphasize that organizational systems face a set of generic problems and that all organizations rely on their structures to solve these problems. This version of the problem-solving framework stems from Georgopoulos' earlier work (Georgopoulos & Matejko, 1967; Georgopoulos, 1970, 1972). Georgopoulos and Cooke's framework has been empirically tested in a study of 30 hospital emergency services (Georgopoulos,

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<sup>1</sup> Assistance and helpful comments were provided by Robert A. Cooke, Basil Georgopoulos, Marina Park, Stanley E. Seashore, and Jane Stanton. The data employed in this report are from a study subsidized by the Department of Psychology of the University of Michigan.

Cooke, and Associates, 1980) and a modified version of this framework has been tested in a study of 25 public schools by Cooke and Rousseau (1980). Hence, the present study of hospital subunits is complementary to, and an extension of, these two earlier inquiries.

Hospital subunits were viewed as problem-facing and problem-solving social systems and it was posited that subunit effectiveness depended on discovering appropriate solutions to a set of generic problems. Further, it was proposed that these open systems must rely on their structures in order to solve this set of universal problems. Stemming from this theoretical framework, the purpose of the present investigation was to explore the relationships among structural appropriateness, problem-solving adequacy, and effectiveness in a sample of 52 hospital subunits.

## THEORETICAL FRAMEWORK

### The Problem-solving Perspective

In one of the earliest statements of the organizational problem-solving perspective, Parsons, Bales, & Shils (1953) contended that every organization is confronted with a set of four functional problems. These problems were labeled "system problems" by Bales (1953) and were characterized as universal exigencies for all forms of social systems. The four functional problems discussed by Parsons, Bales, and Shils (1953) were summarized by Etzioni (1975) in the following manner:

- 1) Adaptation--the system's need to control the environment.
- 2) Goal attainment--the gratification of the system's goals.
- 3) Integration--the maintenance of solidarity among the system's units.
- 4) Latency or tension management--the reinforcement of the integrity of the value system and its institutionalization.

Moreover, Parsons (1958, 1960) continued to describe organizations as problem-solving systems in his General Model of Formal Organizations.

The problem-solving approach was also embodied in the work of Simon and his colleagues (Cyert & March, 1973; March & Simon, 1958; Simon, 1957b). Thompson (1967) described the work carried out by Simon and his colleagues in the following manner: "What emerges from the Simon-March-Cyert stream of study is the organization as a problem-facing and problem-solving phenomenon" (p. 9). The Simon-Cyert-March approach was a cognitive one while Parsons and his colleagues took a structural/functionalist approach. In fact, March and Simon (1958) implied that individual and organizational problem-solving processes are almost identical. However, these two approaches are similar in one critical respect: organizations were thought to be problem-solving entities by both groups of theorists.

The problem-solving perspective was expanded in the work of Georgopoulos and his colleagues on hospitals and their subunits (Georgopoulos & Matejko, 1967; Georgopoulos, 1970, 1972; Georgopoulos & Cooke, 1979; Georgopoulos, Cooke and Associates, 1980). Like March and Simon, Georgopoulos viewed complex organizations and their subunits as problem-facing and problem-solving systems. Moreover, his problem-solving framework was firmly grounded in open-systems theory. Georgopoulos & Matejko (1967) related several problems to system properties and Georgopoulos proposed that "the basic system properties of organizations...have important implications for the problems that organizations face" (1972, p. 16). However, while Georgopoulos makes the general assertion that properties and problems are interrelated and derives specific problems from specific properties in his earlier work, Georgopoulos and Cooke were the first to explicitly point out that a set of system problems could be derived from a set of open system properties. For example, they explain how the problem of coordination can be derived from the property of interdependence. As open systems, all organizations are composed of inter-related subsystems and components that are contingent upon one another. This is the system property of interdependence. These interdependent subsystems and components must be articulated in time and space, or coordinated. Hence, the system property of interdependence gives rise to the system problem of coordination (Georgopoulos & Mann, 1962). More complete examples of derivations of problems from properties can be found in Georgopoulos & Cooke (1979). Ford & Sutton (1980) and Cooke & Rousseau (1980) also follow Georgopoulos & Cooke's model closely.

Georgopoulos (1972) expanded the set of system problems developed by Parsons et al. (1953). This set of problems, along with the rest of the problem-solving framework developed by Georgopoulos and Cooke, was modified for use in the present investigation. The set of generic system problems examined in this study were coordination, adaptation, external maintenance, resource acquisition, resource allocation, integration, strain amelioration, and goal attainment. Each of these problems is defined below.

Coordination. March & Simon (1958) define this as "the problem of arranging the signalling system for interdependent conditional activities" (p. 28). Hence, the coordination problem is one of articulating the activities of organizational members in time and space (Georgopoulos, 1972).

Adaptation. This is the problem of responding to changes in the environment by bringing about or allowing changes within the organization itself (Georgopoulos, 1972; Georgopoulos & Tannenbaum, 1957). As open systems, organizations and their subunits must adopt new structures and technologies and modify existing ones on a continuing basis in order to survive and flourish. In the case of hospital subunits, it is particularly important to keep pace with technical changes in order to provide the highest quality patient care or provide the best possible ancillary services.

External maintenance. This is the problem of preserving the organization's identity and integrity in the face of environmental changes that threaten the stability of the system. External maintenance is necessary in order to ensure that the system receives adequate inputs and that it is not subject to excessive intrusion from outside groups. External maintenance is distinguished from adaptation by the focus of action. Adaptation implies internal organizational changes in response to

environmental changes. External maintenance implies actions by the organization that are intended to change the task environment without making internal changes. The difference between external maintenance and adaptation is one of proaction versus reaction. We distinguish between two types of maintenance: external maintenance and internal maintenance (Ford & Sutton, 1980). Internal maintenance is the problem of maintaining stable relationships within the system. This form of maintenance was not examined in the present investigation. However, Georgopoulos and Cooke do not distinguish between the two forms. They define maintenance as the ability of the system to maintain its basic character in the face of both internal and environmental changes.

Resource acquisition. This is the problem of obtaining adequate energy inputs for the system. Examples of energy inputs include raw materials, capital, personnel, and information. Resources such as these are acquired through energy exchanges with the environment. Organizational survival depends on the maintenance of a positive balance of energy inputs, or negentropy (Katz & Kahn, 1978). In other words, the total energy inputs must exceed the total energy outputs. For Yuchtman & Seashore (1967) resource acquisition is organizational effectiveness. They state, "We propose, accordingly, to define the effectiveness of organization in terms of its bargaining position, as reflected in the ability of the organization, in either absolute or relative terms, to exploit its environment in the acquisition of scarce and valued resources" (p. 898). While we view resource acquisition as an important problem that all organizational systems must solve in order to be effective, we do not define it as the sole indicator of organizational effectiveness. Rather, it is one of a set of problems that all organizations must solve or manage continuously. The problem of resource acquisition is not described by Georgopoulos (1972) or by Georgopoulos and Cooke (1979). However, it is identical to Cooke and Rousseau's problem of input.

Resource allocation. This is the problem of distributing available resources in an appropriate manner. Organizations and their subunits must not only acquire resources; they must allocate physical space, money, information, materials, personnel, and rewards equitably and efficiently (Georgopoulos, 1972; Georgopoulos & Cooke, 1979).

Integration. This is the problem of binding members to the organizational system. Note that these bonds are psychological rather than physical in most instances. The problem of integration has been solved when most members feel as if they are an important part of the organization and they have internalized the system's goals and objectives. Following from Schwarz (1980), integrated members are willing to expend considerable effort for the organization, feel a sense of identification with the organization, are involved with their jobs, and have a desire to remain in the organization. Although a few notable exceptions do exist (e.g., prisons), human beings are partially included in most organizational systems (Allport, 1933). They are members of other role sets such as families and community organizations. Hence, organizational effectiveness is partially dependent on the acquisition of a large enough "psychological slice" from each system member. This concept of integration is different than the one used by Lawrence and Lorsch (1969). They

define integration as "the quality of the state of collaboration that exists among departments that are required to achieve unity of effort by the demands of the environment" (p. 11). We would classify this as a coordination problem, not one of integration. In addition, this concept of integration is more narrow than that described by Georgopoulos and Cooke. Their concept includes the integration of organizational structures. Our concept comprises only the integration of members.

Strain amelioration. The problem with strain amelioration is one of minimizing the inevitable tensions and conflicts that arise within organizations (Georgopoulos, 1972). Despite the best efforts of administrators, managers, supervisors, and other employees, conflict and tension between individuals and between groups is inevitable in all hospital subunits, as in all other types of social aggregates. Hence, those organizational units that are able to quickly reduce or eliminate interpersonal strain or conflicts as they arise are said to be solving or managing the problem of strain amelioration.

Goal attainment. Goal attainment or "enjoyment of the goal state" (Parsons, Bales, & Shils, 1953) is the problem of reaching and maintaining high levels of output (Georgopoulos, 1972). Goal attainment occurs when an organizational system has accomplished its formal, stated, or actual task or mission. Of course, organization members do not simply quit working in order to "enjoy the goal state". The outputs must be exchanged for new inputs in order to maintain the system. Organizations, as open systems, are input-throughput-output devices (Katz & Kahn, 1978; Miller, 1978). As with all of the generic problems, solving the problem of goal attainment requires constant activity on the part of the organizational units and their members. Note that the problem of goal attainment is not included in Georgopoulos and Cooke's framework, but it was included in Georgopoulos' earlier version of the problem-solving framework. In addition, the concept of goal attainment presented here is very similar to Cooke and Rousseau's problem of output.

Organizational effectiveness depends on the discovery of appropriate solutions to this set of universal problems. Hence, the organizational problem-solving mechanisms are an integral part of the framework used in the present investigation. Following the Georgopoulos and Cooke model, we propose that these mechanisms include organizational structures.

### Structure

The concept of social structure has long been problematic (Blau, 1975; Scott, 1975). The structure of physical system is relatively easy to ascertain. because the components of such a system and the links that interconnect them can be observed directly. The structure of a social system also contains observable components, human beings. However, the links that interconnect these humans are not directly observable. Rather, the existence of links must be inferred from corresponding patterns of behavior among people in that system. Consequently, the structure of a social system is found in the arrangement of causal links among the human members and in the arrangement of the members linked (Blalock & Blalock, 1959; Feibleman & Friend, 1945). Organization members are connected by various types of links (Georgopoulos & Cooke, 1979), including authority (Parsons, 1958; Weber, 1947), information

(Guetzkow, 1965; Leavitt, 1951; Porter & Roberts, 1976), and role expectations (Biddle & Thomas, 1966; Katz & Kahn, 1978). These examples represent the authority structure, communication structure, and role structure, respectively.

The concept of social structure presented here is similar to Georgopoulos and Cooke's. They define structure as the manner in which system elements are ordered and coupled on the basis of some controlling principle. They identify three types of elements that can be ordered and coupled in organizations: human beings, performance programs, and cycles of events (similar to behaviors). Each of these is considered to be a different order of structure. In contrast, the model of structure presented here includes only one type of element: human beings.

For the sake of conceptual clarity, one aspect of structure deserves special mention here. March & Simon (1958) suggested that performance programs are part of an organization's structure. They defined performance programs, or simply programs, as "situations in which a relatively simple stimulus sets off an elaborate program of activity without any apparent interval for search problem solving, or choice" (p. 143). Programs, are viewed as sets of role expectations or behavioral guidelines for recurring situations. They specify which behaviors are expected of individual organization members or sets of interdependent members. Hence, performance programs are defined as part of the role structure in this study. In contrast, Georgopoulos and Cooke describe performance programs as second order structures, which are distinct from the role structure.

#### Organizational Structure and Problem Solving

Organizational structures have often been described as problem-solving mechanisms. Parsons (1958, 1960) viewed structures as mechanisms for solving a universal set of problems in his General Theory of Formal Organizations. Parsons broke down the organizational hierarchy into three parts that he referred to as subsystems, or structures. These three qualitatively different structures were labeled technical, managerial, and institutional and each was charged with solving a different set of universal system problems. He also referred to these problems as functions, responsibilities, or exigencies. Moreover, in his extension of Parsons' work, Thompson (1967) also contended that structural arrangements are used by organizations to solve problems. Thompson believed that coordination was a central problem for the technical subsystem. He asserted that: "It is the task of structure to facilitate the exercise of the appropriate coordinating processes" (p. 64).

In addition, March & Simon also theorized that organization structures are tools for problem solving. They stated that organization structure included performance programs and switching rules for choosing appropriate programs for short-run adaptiveness, or problem solving, and procedures for developing, elaborating, instituting, and revising programs for long-run adaptiveness or learning. Thus, structures were described as mechanisms for organizational problem solving and learning. Note that the concept of problem solving used in the present study includes both long- and short-run adaptiveness. Hence, the March & Simon concepts of problem solving and learning are embraced by our concept of problem solving.

The view that organization structures are problem-solving mechanisms is also implicit in both editions of Katz & Kahn's The Social Psychology of Organizations (1966, 1978). They proposed that all organizational systems are composed of five subsystem structures and that each of these structures has the task of carrying out a specific set of functions. These functions are virtually identical to what we have described here as organizational problems. They include such organizational exigencies as accomplishing tasks, coordination, and obtaining support and legitimation from the environment. We assert that there is no essential difference between relying on structures to solve problems or to carry out functions.

The problem-solving framework developed by Georgopoulos and his colleagues (Georgopoulos & Matejko, 1967; Georgopoulos, 1970, 1972; Georgopoulos & Cooke, 1979) also included the concept that organization structures are the basis for solving generic system problems. Georgopoulos & Cooke asserted that organizational structures are primary mechanisms for solving organizational problems. They state: "the role structure, normative structure, authority structure, communication structure, etc.--constitute the basic problem-solving framework of the system. Structures make it possible for the system to deal with problems faced by the system" (p. 9).

Although our concept of social structure is less differentiated than Georgopoulos and Cooke's, this general concept of organization structure was adopted for use in the present investigation. Following from Georgopoulos and Cooke, we propose that organizational systems rely on their structures to solve the set of generic system problems and that the problem-solving capacity of an organization, or one of its subunits, depends on the appropriateness of its structures. For example, the normative structure of an organization is an important mechanism for socializing members. The words and actions of other organization members provide the new member with information about how he or she should behave. Thus, organizations rely on their normative structures to socialize new members. This helps organizations solve the problem of member integration. However, the norms must be appropriate to help socialize new members. They must provide information that will result in psychological attachment to the system rather than psychological withdrawal. Performance programs are another example. March & Simon (1958) contended that organizations use performance programs to help solve the problem of coordination and that they must be appropriate for the type of coordination required by each system. To illustrate this point, the members of a surgical intensive care unit must monitor their clients closely at all times. Moreover, they must be prepared to execute a wide range of complicated medical procedures at moments notice. Hence, the actions of all unit members must be precisely specified for a wide range of recurring situations. As a result, solving the coordination problem in a surgical intensive care unit requires performance programs that specify detailed courses of action for all unit members in a wide variety of situations. In contrast, performance programs that specify detailed courses of action are not appropriate for solving the coordination problem in an administrative unit. As Mintzberg (1973) has shown, managerial work does not lend itself to precisely specified, pre-programmed activities; managers need a relatively high level of flexibility.

### Problem Solving and Organizational Effectiveness

A wide variety of organizational theorists have defined organizational effectiveness as a multifaceted concept (e.g., Cameron, 1978; Campbell, 1974; Georgopoulos & Tannenbaum, 1957; Goodman & Pennings, 1977; Katz & Kahn, 1978). These theorists generally contend that there are too many possible organizational processes and outcomes for any single effectiveness indicator to serve well. This multifaceted perspective is reflected in Georgopoulos and Cooke's framework and in the two earlier studies (Georgopoulos, Cooke and Associates, 1980; Cooke and Rousseau, 1980) that empirically tested this problem-solving framework. In this paper organizational effectiveness is viewed as a function of how well each hospital subunit was able to solve each of the following generic problems: coordination, adaptation, external maintenance, resource acquisition, resource allocation, integration, strain amelioration, and goal attainment. Each of these problems must be solved on an ongoing basis to ensure that the system will continue to survive and beyond that to flourish. Thus, an effective social system is defined here as one that acts to ensure long-term survival and growth without depleting the resources and legitimation it obtains from the environment. This definition is derived from theory and research using the natural systems model of organization effectiveness (e.g., Argyris, 1964; Katz & Kahn, 1966; Yuchtman & Seashore, 1967). However, it is generally not possible to measure long-term survival and growth in research on organizations; it is simply too costly and time consuming (Aldrich & Pfeffer, 1976; Pfeffer, 1977). Researchers are generally forced to rely on surrogate measures to help them estimate the probability that a system will survive and grow over time. These surrogate measures are usually perceptions of overall system effectiveness obtained from a variety of knowledgeable observers. Thus, it is not usually possible to directly measure organizational effectiveness as it is defined here; it must be inferred from theoretically derived alternative sources of data.

### Hypotheses

The purpose of this study was to explore relationships among structural appropriateness, problem-solving adequacy, and effectiveness in sample of hospital subunits. Drawing from the theoretical perspective described above, and from the two earlier investigations upon which the present study is based (Georgopoulos, Cooke, and Associates, 1980; Cooke & Rousseau, 1980), we contended that all organizational subunits must solve a set of generic system problems, that the adequacy of problem solving depends on the appropriateness of subunit structures, and that subunit effectiveness depends on how well the system is able to solve a set of generic problems. This theoretical perspective allowed us to make the following four hypotheses, all of which were taken from or derived from the prior cited work:

Hypothesis 1: Structural appropriateness will be positively related to problem-solving adequacy.

Hypothesis 2: Structural appropriateness will be positively related to overall subunit effectiveness.

Hypothesis 3: Problem-solving adequacy will be positively related to overall subunit effectiveness.

Hypothesis 4: The relationships between structural appropriateness and subunit effectiveness will be mediated by problem-solving adequacy.

## METHOD

### Hospital Subunits

A sample of 52 hospital subunits participated in this study. All 52 subunits were from a large, short-stay hospital in the midwest. This sample included a wide range of nursing and non-nursing subunits including surgical intensive care, personnel, emergency services, organization development, radiology, food service, medical intensive care, security services, and surgery. Subunit size ranged from 4 full-time equivalents to 173, with a mean of 41.

### Subunit Members

The members of each subunit were used in this study as observers of subunit effectiveness. A random sample of 25 percent of the employees in each of the 52 subunits was drawn. Questionnaires were distributed to all types of personnel at every level of the participating subunits, including staff nurse, escort, pharmacist, engineer, head nurse, respiratory therapist, secretary, licensed practical nurse, security officer, and business manager. Of the 518 questionnaires distributed, 361 were returned for an overall response rate of 70 percent. The response rate within subunits ranged from 13 percent to 100 percent, with a median of 72 percent. The sample comprised 292 women and 69 men and included 28 blacks, 8 Asians, 2 Mexican-Americans, 319 whites and 3 persons of other racial origin.

### Procedures

The procedures used in this study entailed interviewing the head of each subunit or a high-ranking manager or supervisor, distributing questionnaires to all randomly selected employees, and interviewing two high-ranking hospital executives. A detailed structured interview was administered by a member of the research team to the head of each participating subunit or to his or her close assistant. In 49 of the 52 subunits, the interview was administered to the highest-ranking supervisor or manager; in the remaining 3 subunits the interview was given to a high-ranking supervisor or manager who worked closely with the subunit head. This structured interview was used to measure a variety of subunit attributes including problem-solving adequacy, structural appropriateness, and effectiveness.

As mentioned above, 25 percent of the employees in each subunit were randomly selected to complete a questionnaire. Each of the selected employees was contacted personally by one of the researchers who explained the purpose of the study and answered any questions the employee had. The selected employees were also asked to complete the questionnaires on their own time.

The questionnaire included items on a variety of topics, including job characteristics, job satisfaction, job involvement, nonwork activities, and subunit effectiveness. Only the questions about overall subunit effectiveness were used in this study.

In addition to the detailed structured interview and the questionnaire, two high-ranking hospital executives were administered a brief structured interview. This interview was used to measure the effectiveness of the 52 participating subunits from the perspective of the hospital administration.

## INSTRUMENTS

### Subunit Problem-solving Adequacy

The structured interview was used to measure problem-solving adequacy from the perspective of each subunit head. The set of nine scales used to measure problem solving are coordination, technical adaptation, hospital adaptation, external maintenance, resource acquisition, resource allocation, integration, strain amelioration, and goal attainment. All of these variables were measured with five-point Likert-type response options. Internal consistency reliabilities were computed for each scale with Cronbach's alpha and are presented in Table 1. The items that constitute each of the nine problem-solving scales are presented in the appendix.

Coordination is the problem of articulating interdependent activities in space and time. A four-item scale based on a set of items formulated by Georgopoulos & Mann (1962) was developed to measure coordination. It was operationalized as the ability of subunit members to plan, schedule, and execute their activities so that they were well-timed and did not interfere with each other's work. Adaptation is the problem of responding appropriately to relevant changes in the subunit's task environment. Two aspects of the adaptation problem were examined, technical adaptation and hospital adaptation. Technical adaptation is the problem of keeping up with relevant changes and innovations in the task environment (Cooke, 1979). It was measured with a four-item scale developed for use in the present study. Each interviewee was asked if his or her subunit had all the latest equipment and machines, if it was doing all that it should to train members in the latest techniques, and to what extent the unit was keeping up with relevant technical changes in general. Hospital adaptation is the problem of satisfying the needs and demands of the parent hospital. A four-item hospital adaptation scale was developed for this study. Respondents were asked if their subunit's goals and objectives were consistent with those of the parent hospital, if the quality of service provided by the subunit was acceptable to the hospital administration, and if the unit had been responsive to changes in the needs of the hospital.

External maintenance is the problem of maintaining the subunit's basic character in the face of environmental changes and demands. A five-item scale was developed to measure external maintenance. It was operationalized as the ability of the system to buffer itself from excessive influence and unreasonable demands from the hospital administration and clients. Resource acquisition is the problem of obtaining adequate energetic inputs. It was

measured with a seven-item scale. Some of the items in this scale were based on another scale developed by Georgopoulos, Cooke et al. (1978) to measure resource acquisition in a study of hospital emergency services. Resource acquisition was operationalized in the present study as the degree to which the participating subunits were able to obtain adequate physical space, funds, equipment, and services from other units. Resource allocation is the problem of appropriately distributing available resources. Drawing on questions developed for measuring resource allocation in school settings (Coughlan & Cooke, 1974), the researchers developed a seven-item scale for use in the present investigation. Resource allocation was operationalized as the degree to which participating subunits made effective use of existing resources such as physical space, extrinsic rewards for members, equipment, and supplies.

Integration is the problem of binding members to the organizational subunit. While the six-item scale presented in the appendix was developed for the present study, the items that constitute this scale were borrowed from, or based on, measures from a variety of sources. These sources include a study of hospital emergency services (Georgopoulos, Cooke, et al., 1978) and research on schools (Coughlan & Cooke, 1974; Schwarz, 1980). Integration was measured by asking each of the individuals interviewed if employees in their unit were willing to give a lot of effort to do their jobs and develop new work methods, if the goals of most individual unit members were consistent with the goals of the unit, and if most employees felt that they were an important part of their unit.

Strain amelioration is the problem of minimizing the inevitable tensions and conflicts that arise within organizations. It was measured with a three-item scale that was developed by the researchers. The scale was based on a set of items developed for measuring strain amelioration in hospital emergency rooms (Georgopoulos, Cooke, & Associates, 1978). Strain amelioration was operationalized as the degree to which there was little tension among unit members and disagreements were usually worked out to everyone's satisfaction and did not lead to long-lasting tension and conflict. The final problem was goal attainment. This is the problem of reaching and maintaining high levels of output. A five-item goal attainment scale was developed by the researchers for use in this study. It was operationalized as the extent to which a subunit was able to reach its goals and objectives, complete the job or jobs expected of it, and provide high quality service at a low cost.

#### Subunit Structural Appropriateness

An appropriate structure is one that helps the subunit and its members solve the set of generic system problems described above. Stated differently, it is one that increases the problem-solving capacity of the system (Georgopoulos, 1972). As with problem-solving adequacy, the interview was used to measure structural appropriateness from the perspective of the subunit head. The appropriateness of subunit structure was measured with four scales. The scales are authority structure, normative structure, role distribution, and performance program appropriateness. Both role distribution and performance program appropriateness are indicators of the problem-solving capacity of the role structure.

The approach used in this study to assess the problem-solving capacity of organizational structures was first used in a study of hospital emergency services (Georgopoulos, Cooke, & Associates, 1980). An appropriate structure was operationalized here as one that simultaneously maximized three criteria of rationality. In the measures of authority structure, normative structure, and role distribution appropriateness these three criteria of rationality were clinical efficiency (providing high quality service), economic efficiency (providing service at the lowest possible cost), and social efficiency (maintaining a high level of job satisfaction). In the fourth structural measure, performance program appropriateness, the three criteria of rationality used were clinical efficiency, economic efficiency, and time efficiency (providing service as promptly as possible). All of the items that constitute these scales were measured with five-point Likert-type response options. These items are presented in the appendix. In addition, internal consistency reliabilities were computed for each structural appropriateness scale and are presented in Table 1.

The scales used for measuring authority structure appropriateness, normative structure appropriateness, and role distribution appropriateness were all developed for use in the present investigation. The authority structure is the manner in which unit members in various positions are linked by decision-making power. The problem-solving capacity of the authority structure was operationalized with a three-item scale. Subunit heads were asked how appropriate the distribution of authority was within the unit from the standpoint of the three criteria of rationality described above. Norms are expectations that are shared by all, or nearly all, of the members of a social system (Katz & Kahn, 1978). A three-item scale was used here to measure normative structure appropriateness. A specific set of norms was examined in the present investigation, norms about work performance. Hence, normative structure appropriateness was operationalized as the extent to which expectations shared among unit members about work standards maximized the three criteria of rationality.

Roles describe the patterns of behavior expected of organization members in given positions (Katz & Kahn, 1978). The role structure is the way in which expected behaviors are allocated to individuals in various positions and the nature of the interconnections among the positions. Two aspects of role structure appropriateness were explored in this study, role distribution appropriateness and performance program appropriateness. Role distribution appropriateness is the extent to which the allocation of activities among various positions enhance the problem-solving capacity of the system. It was operationalized as the degree to which the division of labor within the unit was appropriate from the standpoint of providing high quality care, maintaining a high level of member satisfaction, and providing low-cost service. While role distribution appropriateness measures the allocation of expected activities among various positions, performance program appropriateness is a measure of how much the expectations themselves, or more precisely a subset of the expectations, increase or decrease the problem-solving capacity of the system. As described above, performance programs are behavioral guidelines for recurring situations. They are part of the role structure because they specify what is expected of individuals or sets of interdependent individuals in circumstances that tend to arise with

Table 1  
Internal Consistency Reliabilities

Scale	Cronbach's Alpha
Authority structure appropriateness	.82
Normative structure appropriateness	.68
Role distribution appropriateness	.57
Performance program appropriateness	.71
Coordination	.67
Technical adaptation	.62
Hospital adaptation	.69
External maintenance	.56
Resource acquisition	.80
Resource allocation	.80
Integration	.76
Strain amelioration	.62
Goal attainment	.65
Effectiveness--unit head perspective	.52
Effectiveness--hospital perspective	.81
Effectiveness--member perspective	.90

regularity. Performance program appropriateness was assessed with a three-item scale developed for measuring the quality of procedures used in hospital emergency services (Georgopoulos, Cooke, et al., 1978). It is not possible to obtain usable data by asking respondents to describe the appropriateness of their behavioral guidelines for recurring situations. Procedures are a useful surrogate for performance programs. Procedures were defined as written and unwritten guidelines that specify employee actions in recurring circumstances. In other words, these are predetermined programs of activities. Thus, performance program appropriateness was measured by asking participating unit heads how appropriate the procedures used by their units were for providing service that was high quality, low cost, and prompt.

#### Overall Subunit Effectiveness

If subunit effectiveness depends on problem-solving adequacy, then it is necessary to measure effectiveness as well as problem-solving adequacy to obtain evidence that supports or refutes the theoretical framework described above. We define an effective subunit as one that has a high probability of long-term survival and growth and a low probability of depleting the resources and legitimation it receives from the environment. However, survival and growth cannot be measured directly in a cross-sectional study; they must be inferred from other data sources. Thus, knowledgeable observers were used as observers of subunit effectiveness in the present study. Perceptions of overall effectiveness for each of the participating subunits were obtained from the unit head, unit members, and high-ranking hospital executives. These perceptions were combined into three different scales: overall effectiveness--unit head perspective, overall effectiveness--member perspective, and overall perspective--hospital perspective. The items that constitute these scales were measured with five- and seven-point Likert-type response options. These items are presented in the appendix. In addition, internal consistency reliabilities were computed with Cronbach's alpha for all three scales are presented in Table 1.

Overall effectiveness-unit head perspective was measured with a three-item scale developed for use in the present investigation. It was operationalized as the degree to which participating subunits were described as generally effective, effective at running smoothly, and effective at coping with unexpected problems. Overall effectiveness--member perspective was measured with a thirteen-item scale developed for use in this study. This form of effectiveness was operationalized as the degree to which members of each unit reported that their coworkers, supervisor, and unit as a whole were effective in making things run smoothly, getting things done, and coping with unexpected problems. In addition, the scale included an item that measured how effective the unit was in general. This variable was aggregated from individual responses to form a mean effectiveness score for each unit. Evidence about whether or not an aggregate variable measures something at the unit level is indicated by the ratio of between-group to within-group variance (Georgopoulos & Tannenbaum, 1957; Przeworski & Teune, 1970). An ANOVA was performed using individual perceptions of unit effectiveness as the dependent variable and hospital subunits as the independent variable. The between-group variance is significantly greater than the

within-group variance ( $F = 1.5$ ;  $df = 51,305$ ;  $p \leq .05$ ). This suggests that the aggregated variable does measure a unit-level phenomenon. Finally, overall effectiveness-hospital perspective was measured with a four-item scale developed by the researchers. The hospital executives were asked to indicate how effective each of the 52 participating hospital units was at adapting to the needs and demands of the hospital and at keeping up with relevant technical changes and innovations and how effective the unit was overall. In addition, the executives were asked to indicate what type of reputation each unit had as a good place to work.

#### ANALYSIS AND RESULTS

The product-moment correlations among all variables examined in this study are presented in Table 2. The multiple regression analysis presented in Tables 3 through 6 were used to test the four hypotheses described in the introduction. The findings relevant to each hypothesis will be discussed in turn.

Hypothesis 1: Structural appropriateness will be positively related to problem-solving adequacy.

The results obtained by regressing the nine problem-solving variables on the set of four structural appropriateness variables are presented in Table 3. These findings provided strong support for Hypothesis 1; seven of the nine regressions resulted in significant ( $p \leq .05$ ) squared multiple regression coefficients ( $R^2$ ). Only resource acquisition and technical adaptation were not significantly related to structural appropriateness.

An examination of the beta weights provides information about the contribution of individual structural variables. Authority structure and performance program appropriateness both predicted positively to coordination and external maintenance. Role distribution appropriateness predicted positively to resource allocation, performance program appropriateness predicted positively to hospital adaptation, and normative structure appropriateness predicted positively to integration. In addition, although strain amelioration had a significant  $R^2$  overall, none of the individual structural appropriateness measures had a significant beta weight. Thus, the combined effects of these variables were significant, but no single measure predicted a significant amount of the unique variance in strain amelioration. An examination of the remaining significant beta weights indicates that normative structure appropriateness predicted positively to goal attainment. Hence, the individual beta weights also provide support for Hypothesis 1; all of the significant weights indicated a positive relationship between structural appropriateness and problem-solving adequacy.

Moreover, the product-moment correlations presented in Table 2 provide further support for this hypothesis. Of 36 correlations between problem solving and structural appropriateness presented in this table, 26 are significant ( $p \leq .05$ ) and all significant correlations are positive.

Hypothesis 2: Structural appropriateness will be positively related to overall subunit effectiveness.

Table 2  
Correlations of All Variables

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
1. Authority structure																
2. Normative structure	.24															
3. Role distribution	.64*	.27														
4. Performance programs	.57*	.32*	.61*													
5. Coordination	.58*	.36*	.47*	.61*												
6. External maintenance	.46*	.14*	.31*	.42*	.51*											
7. Technical adaptation	.14	.23	.29*	.29*	.31*	.34*										
8. Hospital adaptation	-.07	.33*	-.06	.35*	.32*	.24	.47*									
9. Resource acquisition	.19	.33*	.12	.32*	.27*	.57*	.18	.15								
10. Resource allocation	.29*	.18	.49*	.46*	.53*	.51*	.43*	.28*	.35*							
11. Integration	.34*	.55*	.35*	.40*	.55*	.32*	.33*	.24	.14	.32*						
12. Stress amelioration	.40*	.16	.38*	.40*	.54*	.39*	-.01	.16	.20	.39*	.50*					
13. Goal attainment	.39*	.42*	.49*	.63*	.63*	.40*	.57*	.51*	.17	.40*	.48*	.42*				
14. Unit effectiveness																
--unit head perspective	.54*	.23	.49*	.60*	.73*	.53*	.51*	.31*	.24	.53*	.53*	.46*	.64*			
15. Unit effectiveness																
--hospital perspective	.07	.04	-.07	.17	.16	.10	.21	.38*	.16	.10*	-.01	-.01	.15	.16		
16. Unit effectiveness																
--member perspective	-.06	.26	-.06	.23	.12	-.28*	.10	.24	.07	.28*	.07	-.04	.26	.02	.31*	

\*p < .05

Table 3  
Multiple Regression of Problem-solving Adequacy on Structural Adequacy

Structural Adequacy	Coordination <sup>a</sup>		Maintenance <sup>b</sup>		External <sup>c</sup>		Technical <sup>d</sup>		Hospital <sup>e</sup>		Adaptation <sup>f</sup>		Acquisition <sup>g</sup>		Resource <sup>h</sup>		Allocation <sup>i</sup>		Integration <sup>j</sup>		Amelioration <sup>k</sup>		Strain <sup>l</sup>		Goal <sup>m</sup>		Attainment <sup>n</sup>	
	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t	Beta	t
Authority structure	.35	2.49 <sup>a</sup>	.35	2.07 <sup>a</sup>	.16	.87	.24	1.42	.08	.42	.11	.65	.10	.65	.10	.65	.20	1.11	-.05	-.29								
Normative structure	.17	1.50	-.00	-.03	.14	.95	.02	.11	.27	1.88	.02	.14	.46	3.75 <sup>a</sup>	.01	.08	.23	2.01 <sup>a</sup>										
Role dis-structure	-.02	-.10	-.07	-.37	.25	1.28	-.27	-1.54	-.17	-.94	.40	2.35 <sup>a</sup>	.08	.48	.10	.84	.16	1.02										
Performance program	.37	2.63 <sup>a</sup>	.27	1.60 <sup>a</sup>	.19	1.03	.67	3.99 <sup>a</sup>	.30	1.65	.28	1.72	.14	-.88	.22	1.23	.48	3.34 <sup>a</sup>										
r <sup>2</sup>	.49 <sup>a</sup>		.26 <sup>a</sup>		.14		.27 <sup>a</sup>		.18		.31 <sup>a</sup>		.37 <sup>a</sup>		.20 <sup>a</sup>		.46 <sup>a</sup>											

<sup>a</sup>p < .05 (4, 46) p < .01

<sup>b</sup>p < .05 (4, 46) p < .01

<sup>c</sup>p < .05 (4, 47) n.s.

<sup>d</sup>p < .05 (4, 46) p < .01

<sup>e</sup>p < .05 (4, 46) n.s.

<sup>f</sup>p < .05 (4, 46) p < .01

<sup>g</sup>p < .05 (4, 46) p < .01

<sup>h</sup>p < .05 (4, 46) p < .05

<sup>i</sup>p < .05 (4, 47) p < .01

<sup>j</sup>p < .05

The results obtained by regressing the three measures of overall effectiveness on the set of structural appropriateness variables are presented in Table 4. These findings provided limited support for Hypothesis 2. Of the three effectiveness indicators, only overall subunit effectiveness-unit head perspective had a significant  $R^2$  ( $p \leq .05$ ). Further, an examination of the beta weights indicates that performance program appropriateness was the only significant predictor of this indicator of effectiveness. Note that this was a positive relationship. Hence, Hypothesis 2 receives some support; structural adequacy is positively related to effectiveness in one of three instances. In addition, a similar pattern is found in the correlations presented in Table 2. Of 12 correlations between structural appropriateness and effectiveness, the three significant correlations are positive.

Hypothesis 3: Problem-solving adequacy will be positively related to overall subunit effectiveness.

The results obtained by regressing the three subunit effectiveness variables of the set of problem-solving adequacy variables are presented in Table 5. These findings provided support for Hypothesis 3; two of the three effectiveness measures, unit head perspective and member perspective, had significant squared multiple correlations ( $R^2$ ). The third  $R^2$ , effectiveness--hospital perspective, was not significant. However, hospital adaptation did predict positively to effectiveness--hospital perspective. This significant beta weight within an overall nonsignificant regression may be due to the low correlations all other problem-solving variables had with perceptions of effectiveness from the hospital perspective. Thus, these additional terms in the model may add little to the  $R^2$  but increase the degrees of freedom in the numerator sufficiently to render the  $R^2$  nonsignificant.

An examination of the beta weights indicates that all of the significant ones predicted positively to the effectiveness indicators. This provides further support for Hypothesis 3. Moreover, the product-moment correlations presented in Table 2 also provide some support for this hypothesis. Of the 27 correlations between problem solving and effectiveness, 10 are significant and positive.

Hypothesis 4: The relationship between structural appropriateness and subunit effectiveness will be mediated by problem-solving adequacy.

If problem solving does mediate the relationship between structural adequacy and effectiveness, then, when problem solving is held constant, the relationship between structural adequacy and effectiveness should disappear. Partialling problem solving out of the effectiveness measures has the effect of holding problem solving constant. The results of the regressions of the residual effectiveness scores on measures of structural adequacy are presented in Table 6. The findings provided support for Hypothesis 4. All regressions and individual beta weights were nonsignificant. Further, all  $R^2$ 's were vastly reduced. All three of them were decreased to nearly zero. Thus, a comparison of the findings presented in Tables 4 and 6 provides support for the hypothesis that problem solving mediates the relationship between structural appropriateness and effectiveness.

Table 4  
Multiple Regression of Unit Effectiveness Indicators on Structural Adequacy

Structural Adequacy	Unit Effectiveness Indicators					
	Unit Effectiveness--Unit Head Perspective <sup>a</sup>		Unit Effectiveness--Hospital Perspective <sup>b</sup>		Unit Effectiveness--Member Perspective <sup>c</sup>	
	Beta	t	Beta	t	Beta	t
Authority structure	.25	1.65	.19	.88	-.23	-1.22
Normative structure	.02	.17	.04	.26	.21	1.42
Role distribution	.08	.50	.43	1.90	-.12	-.60
Performance programs	.41	2.75*	.36	1.80	.36	1.87
R <sup>2</sup>		.43*		.10		.15

<sup>a</sup>F=8.70 (4, 47) p<.01

<sup>b</sup>F=1.25 (4, 43) n.s.

<sup>c</sup>F=1.83 (4, 42) n.s.

\*p<.05

Table 5  
Multiple Regression of Unit Effectiveness Indicators on Problem-solving Adequacy

Problem-solving Adequacy	Unit Effectiveness Indicators					
	Unit Effectiveness--Unit Head Perspective <sup>a</sup>		Unit Effectiveness--Hospital Perspective <sup>b</sup>		Unit Effectiveness--Member Perspective <sup>c</sup>	
	Beta	t	Beta	t	Beta	t
Coordination	.43	3.08*	.21	.86	.14	.71
Technical adaptation	.29	2.16*	.10	.46	.12	.64
Hospital adaptation	.08	.77	.38	2.14*	.15	.97
External maintenance	.16	1.22	.13	.56	.71	3.79*
Resource acquisition	.05	.48	.12	.67	.37	2.21*
Resource allocation	.02	.17	.01	.05	.20	1.13
Integration	.05	.43	.15	.77	.05	.30
Strain amelioration	.12	.89	.04	.19	-.19	-.97
Goal attainment	.13	.86	-.10	-.41	.33	1.62
R <sup>2</sup>		.66*		.19		.39*

<sup>a</sup>F=8.88 (9,41) p<.01

<sup>b</sup>F=.97 (9,37) n.s.

<sup>c</sup>F=2.59 (9,37) p<.05

\*p<.05

Table 6  
Multiple Regression of Residualized Unit Effectiveness Variables on Structural Adequacy

Structural Adequacy	Effectiveness Indicators					
	Unit Effectiveness--Unit Head Perspective <sup>a</sup>	Beta	t	Unit Effectiveness--Hospital Perspective <sup>b</sup>	Beta	t
Authority structure	.07	.37	.19	.99	-.03	-.17
Normative structure	.22	1.18	-.02	-.10	-.03	-.17
Role distribution	.05	.26	.20	.84	.14	.69
Performance programs	.22	1.47	.02	.11	.13	.64
R <sup>2</sup>		.07		.02		.02

<sup>a</sup>p=.92 (4, 46) n.s.

<sup>b</sup>p=.26 (4, 42) n.s.

<sup>c</sup>p=.18 (4, 41) n.s.

\*p<.05

## DISCUSSION

Organizational subunits were described above as open systems that rely on their structures to solve a set of generic problems. Moreover, we asserted that subunit effectiveness depends on problem-solving adequacy. The results of this study indicate that subunit structural appropriateness was positively related to problem-solving adequacy and to effectiveness and that subunit problem-solving adequacy was positively related to effectiveness. In addition, the findings suggest that subunit problem-solving adequacy mediates the relationship between structural appropriateness and effectiveness.

These results are consistent with the two previous studies that were replicated by the present investigation. The study of hospital emergency services (Georgopoulos, Cooke, and Associates, 1980) and the study of public schools (Cooke & Rousseau, 1980) both found that the appropriateness of organizational structures was positively related to organizational problem-solving and to various indicators of effectiveness. In addition, these two earlier investigations also obtained evidence that problem-solving mediates the relationship between the appropriateness of organizational structures and effectiveness. Taken together, the results of these two earlier studies and the present investigation provide strong evidence for the problem-solving framework developed by Georgopoulos and Cooke; the results of all three studies suggest that this framework is a useful one for describing organizational systems.

The magnitude of the relationship found between structural appropriateness and problem-solving adequacy provides support for the proposition that organizations rely on their structures to solve problems. The set of structural appropriateness variables predicted 49 percent of the variance in coordination, 26 percent in external maintenance, 31 percent in resource allocation, 27 percent in hospital adaptation, 37 percent in integration, and 30 percent of the variance in strain amelioration. However, the existence of positive relationships between structural appropriateness and problem-solving adequacy is necessary but not sufficient evidence for providing a complete test of this proposition. More rigorous tests would include the use of experimental, or even quasi-experimental, designs often demands more control over organizations than researchers typically have. Further, even the design of a quasi-experiment requires a fairly precise set of hypotheses about causal mechanisms involved. The use of path analytic or causal modeling techniques also demands greater specification of hypotheses than now exists. Therefore, in order for this framework, or one like it, to remain useful and interesting, it will be necessary to begin to specify precise relationships.

It will not be enough to assert a relationship between a set of problems and a set of structures. Instead, the hypotheses must propose relationships of varying magnitudes between each problem and each structural characteristic, and among the problems and structures themselves. However, in the search for increased specification, we must not allow ourselves to be content with mere sophistic complication. The temptation is there and we succumbed; Parsons et. al. (1953) proposed four problems; Georgopoulos & Cooke (1979) proposed six; we have proposed eight; and Cooke and Rousseau (1980) proposed twelve. Although organizations, and even their subunits, are so complex that it may be necessary to have a larger set of problems to describe organizational dynamics accurately, researchers should avoid adding new system problems, or any other organizational attribute, without compelling reason. If the additional complexity is necessary, let us add it only with matching amounts of increased specification.

In addition, future investigations should focus on describing the process by which organizations solve problems. March & Simon (1958) suggested that structure allows organization members to have fairly complete knowledge of a limited set of cause-effect relationships. They asserted that performance programs and switching rules allow organization members to solve problems with a minimum amount of search behavior and proposed that structure is a mechanism for creating spheres in which organization members can achieve bounded rationality. This structure can be thought of as a mechanism for creating spheres in which organizational members can have fairly complete knowledge about a set of work-related cause-effect relationships. Although this proposition may have high face validity, we are not aware of any empirical investigations in which it has been tested directly. While the results of this study suggest that it is a feasible explanation, further research is needed to assess the validity of this proposition. Moreover, alternative explanations for the underlying mechanisms in the relationships among structures and problems must be proposed and tested. Does structure increase the knowledge of cause-effect relationships or does it actually only reduce the possible range of outcomes without any effect on knowledge held by members? Perhaps structures are the outcomes of problem-solving activities; perhaps the causal relationships among structures and problems are reciprocal. These and other alternative explanations must be tested for a complete examination of this approach.

The results of this study provide strong support for the hypothesis that problem-solving adequacy would be positively related to overall subunit effectiveness. The set of problem-solving variables predicted 66 percent of the variance in overall effectiveness--subunit head perspective and 39 percent in overall effectiveness--member perspective. However, note that an effective subunit was defined as one that acts to ensure long-term survival and growth without depleting the resources and legitimation it receives from the environment. Thus, while the squared multiple correlation coefficients are substantial, they should be interpreted with caution because a surrogate measure of effectiveness was used. Hence, longitudinal studies are required in order to obtain the evidence needed for a complete test of the problem-solving framework proposed here. Unfortunately, no longitudinal studies of this kind have yet been completed.

#### CONCLUSION

The problem-solving framework appears to be a promising one for studying organizational systems from both theoretical and empirical perspectives. The findings from this study support the two major propositions derived from this framework: (1) organizational subunits are problem-facing open systems that must solve a set of generic problems to be effective and (2) organizational structures are problem-solving mechanisms. However, although we have evidence of certain relationships, we have no evidence concerning the underlying causal mechanisms for those relationships.

Several steps are necessary before a comprehension of organizational dynamics using this framework can be claimed. First, the theoretical specification of the model must be increased dramatically, and revised as new evidence is obtained. Second, various research methodologies must be employed, including experimental and longitudinal studies. Third, the components of causality must be decomposed using causal modeling techniques. Fourth, alternative explanations must be devised and tested. Fifth, the first steps must be repeated again and again.

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## APPENDIX

### Measures of the Variables

#### I. Subunit Head Interview

Five-point Likert-type response scales were used to measure all of the variables in the structured interview.

##### A. Authority Structure Appropriateness

F4c) Please think of the amount of authority held by people in various positions in your unit. On the whole, how appropriate is this distribution of authority from the standpoint of:

- i) providing service of the highest quality possible?
- ii) maintaining a high level of job satisfaction among members of the unit?
- iii) providing service at the lowest possible cost?

##### B. Normative Structure Appropriateness

F4a) Please think about the work standards held by members of this unit. More specifically, think about the standards concerning what is acceptable and unacceptable work. How appropriate are these standards from the perspective of:

- i) providing service of the highest quality possible?
- ii) maintaining a high level of job satisfaction among members of the unit?
- iii) providing service at the lowest possible cost?

##### C. Role Distribution Appropriateness

F4b) Please think about the way that work is divided up among the various people in this unit. How appropriate is this division of labor from the standpoint of:

- i) providing service of the highest quality possible?
- ii) maintaining a high level of job satisfaction among members of the unit?
- iii) providing service at the lowest possible cost?

##### D. Performance Program Appropriateness

F5a) Please think of the various procedures used by this unit. To what extent are most of them appropriate from the standpoint of

enabling the staff to provide the highest quality service?

F5b) To what extent are these procedures appropriate from the standpoint of enabling the staff to provide service at the lowest cost possible?

F5c) To what extent are these procedures appropriate from the standpoint of enabling the staff to provide service as promptly as possible?

E. Coordination

B1-15) People in this unit use work time efficiently by planning and coordinating their efforts.

B1-50) The people who work in this unit take into account each other's work as they go about doing their own.

D1-19) To what extent do people in this unit do their jobs properly without getting in each other's way?

D1-25) To what extent are related activities well timed in the everyday routine of this unit?

F. Technical Adaptation

B1-26) This unit has all the latest machines and other equipment it needs to provide the best possible service.

B1-34) This unit is doing all that it should to train its members in the latest work methods and techniques.

B1-41) When we decide to use new procedures or equipment in this unit, it usually results in an improvement in the service we provide.

D1-13) To what extent is this unit keeping up with relevant technical changes and innovations?

G. Hospital Adaptation

D1-10) To what extent has this unit been responsive to changes in the needs of the hospital?

B1-25) This unit does an excellent job of responding to the needs of the larger hospital.

B1-40) In general, the quality of the service provided by this unit meets or exceeds the expectations of the hospital administration.

B1-49) The hospital administration is very satisfied with the performance of this unit.

H. External Maintenance

- Bl-16) If the hospital administration makes unreasonable demands on this unit, we can usually convince them to change their demands.
- Bl-42) The people who use the produce or service provided by this unit have too great an impact on the way this unit operates.<sup>1</sup>
- Bl-51) This unit is able to influence decisions made by the hospital administration so that they are favorable to the unit.
- Bl-32) The work this unit must do is hindered by unreasonable demands from the hospital administration.<sup>1</sup>
- DI-11) To what extent can this unit influence the hospital to make changes in policies or procedures?

I. Resource Acquisition

- Bl-20) This unit is able to acquire the physical space it needs to do its work.
- Bl-24) If this unit could operate more smoothly with more space, it would be able to acquire that space.
- Bl-29) This unit is able to obtain the money and equipment it needs to continue to provide adequate service.
- Bl-33) If this unit's needs for services from other units in the hospital were to increase, this unit could obtain them.
- Bl-38) If this unit needed more money and equipment to maintain an adequate level of service, it could obtain them.
- Bl-55) If this unit could improve service with more money and equipment, it could obtain them.
- DI-15) To what extent is this unit able to obtain the services it needs from other units in the hospital?

J. Resource Allocation

- Bl-17) People in this unit are paid fairly based on their work load.
- Bl-18) The layout of this unit is inconvenient for the staff.<sup>2</sup>
- Bl-43) In general, the people in this unit are paid fairly.
- Bl-52) Considering the different qualifications held by members in this unit, pay is administered fairly among them.
- Bl-53) People in this unit have the equipment they need to do their jobs.

Bl-54) The physical layout of this unit interferes with the work we do.

DI-12) In general, to what extent do people have adequate supplies for doing their jobs?<sup>1</sup>

K. Integration

Bl-12) The people here are willing to give a lot of effort in order to meet the basic requirements of their jobs.

Bl-13) The people here are willing to give a lot of effort to do even more than their jobs require.

Bl-14) The people in this unit are willing to give a lot of effort to develop better work methods.

Bl-27) The goals and objectives of the individual members of this unit are consistent with the goals and objectives of the unit as a whole.

Bl-36) Most of the employees in this unit feel as if they are an important part of the unit.

DI-20) To what extent is the quality of the service provided by this unit important to the people who work here?

L. Strain Amelioration

Bl-22) Disagreements among people in this unit rarely lead to continuing bad feelings.

Bl-39) There is little tension among the various people who work in this unit.

Bl-56) When disagreements arise about problems facing this unit, these disagreements are usually worked out to everyone's satisfaction.

M. Goal Attainment

Bl-59) This unit as a whole is capable of reaching its goals and objectives.

Bl-60) This unit is effective as getting the things done it is supposed to do.

DI-16) To what extent is this unit capable of doing the job or jobs it is supposed to do?

DI-17) To what extent does this unit do the job or jobs it is supposed to do?

D1-33) To what extent does this unit provide the highest quality service at the lowest possible cost?

N. Effectiveness--Unit Head Perspective

B1-48) This unit is effective at coping with unexpected problems.

D1-34) In general, to what extent is this unit effective?

D1-35) To what extent is this unit effective at running smoothly with a minimum of confusion?

II. Hospital Executive Interview

Five-point Likert-type response scales were used to measure all of the variables in the structured interview.

A. Effectiveness--Hospital Perspective

A) In comparison to all other hospital units, how effective is each of the following units at adapting to the needs and demands of the hospital as a whole?

B) Compared to other units in this hospital, what kind of reputation does each of the following units have as a good place to work?

C) In comparison to all other hospital units, how effective is each of the following units at keeping up with relevant technical changes and innovations?

D) In comparison to all other hospital units, how effective is each of the following units overall?

III. Unit Member Questionnaire

Five-point Likert-type response scales were used to measure all questionnaire items.

A. Effectiveness--Member Perspective

11-1) How effective is your supervisor at:

a) making things run smoothly?

b) helping you get things done on the job?

c) arranging things so that you enjoy your work?

d) coping with unexpected problems?

11-3) How effective are you at:

- a) getting things done on the job?
- b) helping you get things done on the job?
- c) arranging for work to go as smoothly as possible?
- d) coping with unexpected problems?

11-4) How effective is your unit as a whole at:

- a) getting the things done it is supposed to do?
- b) running smoothly with a minimum of confusion?
- c) helping people who work there get their jobs done?
- d) coping with unexpected problems?

13-2) How effective would you say your unit is overall?

<sup>2</sup> This variable was reverse coded.

## Part II

### ORGANIZATIONAL EFFECTIVENESS IN A RETAIL BROKERAGE FIRM: DIMENSIONS OF PERFORMANCE AND THEIR RELATIONSHIP TO OTHER INDICATORS OF SYSTEM PROPERTIES<sup>1</sup>

Mark Fichman

This paper empirically examines two basic questions related to our conceptual analysis of organizational effectiveness:

1. What are the dimensions of organizational performance?
2. Are the goal attainment, decision making, and natural systems models compatible or incompatible with each other in their representations of organizational effectiveness?

This paper will treat these two questions in turn, starting with the dimensions of performance in an organization.

#### Dimensions of Performance

A number of studies and theoretical approaches have treated the question of the dimensions of performance in organizations. These studies are catalogued and evaluated in other sections of this report. Several points about this work should be noted. Most of the work in this area, with some exceptions (e.g., Seashore & Yuchtman, 1967), has not been informed by a clear theoretical viewpoint. Although most dimensional analyses could probably be categorized as falling into a system, goal attainment, or decision-making perspective, this would be a post hoc judgement with all its attendant errors. Since measurement requires the application of theoretical assumptions and models, the failure to measure organizational performance with clear theoretical guidelines can lead to an empirical quagmire, which is only a mildly unfair characterization of factor analytic and dimensional analyses of organizational performance.

We do not mean or intend to lay the blame for this state of affairs solely on the researchers who have produced these studies. Usually, organizational researchers are constrained by circumstances in their choice of measures. Survey data collection is often the only efficient way to

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collect information on concepts which may not readily lend themselves to self-report or interviewing survey techniques. Behavioral and financial data, which may be more appropriate, are usually too costly to collect without relying on organizational accounting and control systems that are in place. Consequently, variable definitions, collection techniques, and the sample of measures available differ from organization to organization. These types of conditions deter sound theory testing research.

The third difficulty in conducting and evaluating research on organizational performance is the problem of generalizability. Most performance studies use a sample of organizations with unknown population characteristics. Consequently the researcher is on shaky ground in attempting to generalize results to a larger, often ill-defined population. An alternative available to the researchers is to define a more restricted population for which a sample does have external validity. This more limited generalizability is also difficult to obtain. Often, a more restricted population (e.g., industry type, regional population) is difficult to define. Furthermore, the absence of generally accepted organizational demographic concepts (e.g., structure, size, environment, technology) with estimates of their sampling characteristics makes more limited attempts at generalization tenuous at best.

Our approach to the partitioning of organizational performance into dimensions is an exploratory one guided by our interest in the several models of organizational effectiveness. These models, discussed in greater detail in other sections of this report, are the systems model, the goal attainment model, and the decision-making model. In the examination of performance dimensions, we want to see which model is most helpful in the interpretation of the performance dimensions.

In considering this report, the reader should remain aware of the caveats outlined above, the limits on generalizability, and the influence of the data collection methods employed. In particular, the data collection method reflects the choice, by the designers of the data collection system, of a model of organizational effectiveness (e.g., that embodied in accounting and financial control systems). Goals of profitability, cash flow, and inventory levels are often reflected in traditional accounting practices. It is this narrowly focused (in the view of systems theorists) goal orientation which has sparked the interest in human resource accounting, which is a set of accounting concepts more in tune with the systems model of organizational effectiveness. While measurements keyed to a particular model need not be incompatible with alternative effectiveness models, it is often easier to interpret the data within the framework of the model from which the data collection methods were conceived.

#### Method

Our exploration starts by examining the dimensions of effectiveness in a set of 49 performance indicators collected in 171 brokerage offices of an investment brokerage firm in both 1968 and 1969 through the firm's accounting system. The data are from offices in the United States. The

data are collected at the office level rather than aggregated individual level data. The measures, described in Appendix I, cover a wide range of office operations and characteristics. These offices were engaged in the traditional retail and institutional brokerage services usually provided by American brokerage firms.<sup>2</sup> Initially the 1969 data were analyzed using a principal components analyses with a missing data correlation matrix as input. Using Kaiser's criterion, components were selected for inclusion in an orthogonal factor analysis with communalities in the diagonal (squared multiple correlations were used as estimates of the communality values). The factors were rotated using a varimax rotation procedure. The same analysis was conducted using the 1968 data. The two factor solutions were compared employing Ahmaavara's "transformation analysis" as described in Rummel (1970) and operationalized in the FCOMP program in OSIRIS III (OSIRIS III, 1973). This procedure was employed since there were only 150-160 cases for 49 variables in the factor analysis and the resulting factor solution might not be very stable. The confirmatory approach ("transformation analysis") was employed to check the stability of the solution across time.

### Results

The results for the 1969 factor analysis only will be presented below, since they showed good agreement with the 1968 factor solution. An initial examination of the data showed that the size of each office had a powerful effect on the performance indicators (e.g., larger offices had higher sales). This size effect obscured other relationships in the data. Individual regression analyses were run on each performance indicator, with each indicator regressed on size. The residual scores (i.e., the performance scores with size partialled out) were saved and these residuals were entered into the factor analysis routines. Size was operationalized as the number of account executives in each office. When size did not have a significant correlation with a performance indicator, the original performance scores were used.

The performance scores were entered into the factor analysis using the missing data correlation matrix shown in Table 1 with an average N of 160.77 and a range of Ns from 138 to 165. The resulting factor analysis yielded 11 factors which accounted for 78.2% of the total variance in the performance measures. The transformation analysis using FCOMP showed that the solution was fairly stable. The product-moment correlation between the 1968 and 1969 solutions was .866, which, when considered along with the other results from the transformation analysis, indicated a reasonably

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<sup>2</sup> An office was generally comprised of an office manager, a number of account executives (i.e., stock, bond, and commodities brokers), their sales assistants, an operations manager, and operations personnel. Most offices provided a range of retail brokerage services involving the buying and selling of various categories of securities and other investment vehicles to individuals and institutions (e.g., banks, pension funds) in the office working area.

Table 1  
Missing Data Correlation Matrix of Brokerage Office Performance Indicators for 1969

	1006	1007	1010	1014	1020	1035	1040	1046	1062	1077	1088	1091
FLR BRKR INC	1006											
AVAILBLE INC	.589											
INDIVIDUL VOL	.495	.624										
PENSION INCM	.565	.628	.367									
TELEGRAM EXP	.568	.452	.343	.480								
OVER IM COMM	.677	.914	.555	.726	.556							
SH-IM TOTACT	.599	.789	.723	.450	.454	.688						
MARGIN ACCTS	.459	.449	.517	.122	.456	.333	.656					
1H-5H TOTACT	.547	.716	.633	.145	.449	.560	.897	.662				
NEW ACCT COM	.628	.965	.632	.608	.462	.870	.798	.448	.727			
TOT TRANSACT	.565	.867	.585	.443	.398	.680	.778	.507	.842	.867		
ONBOARD INCM	.715	.911	.690	.630	.586	.844	.840	.590	.769	.909	.820	
TOTPROD INCM	.639	.983	.672	.624	.476	.883	.810	.452	.729	.979	.873	.928
SEC&COMM INC	.580	.942	.577	.594	.439	.838	.752	.383	.674	.922	.826	.859
INT ON CASH	.434	.565	.430	.306	.402	.520	.533	.227	.542	.567	.562	.558
OTASUP MONEY	.531	.609	.442	.604	.536	.585	.481	.372	.520	.593	.598	.654
INC-DEBITS	.672	.663	.480	.755	.627	.685	.537	.531	.496	.628	.507	.733
INTER ON CRD	.553	.805	.581	.482	.370	.647	.725	.518	.739	.762	.765	.775
BANK VOLUME	.197	.687	.222	.154	.225	.648	.307	.004	.282	.671	.569	.682
DEALER VOLUM	-.180	.220	-.139	.094	.019	.141	-.087	-.123	-.136	.163	.225	.152
MKTNETTRANS	-.200	.443	.125	.165	-.160	.262	.217	-.017	.220	.495	.182	.406

Table 1 continued

	1006	1007	1010	1014	1020	1035	1040	1086	1046	1062	1077	1088	1091
# OPS PERSNL	1094	.022	.572	.210	.270	.223	.454	.378	.208	.376	.516	.394	.514
OPS SALARIES	1105	.111	.673	.307	.358	.379	.552	.454	.319	.444	.621	.547	.629
ADVERTISING	1024	-.039	-.080	-.181	.043	.095	-.052	-.050	-.033	.000	-.075	-.054	-.089
AE's LSS 1YR	1070	-.287	-.515	-.337	-.248	-.092	-.426	-.446	-.290	-.443	-.511	-.459	-.528
TOT AE CHNGE	1072	-.217	-.430	-.313	-.173	-.014	-.330	-.410	-.280	-.416	-.422	-.396	-.439
SALES PROMOS	1025	-.077	.077	-.068	0.114	-.077	.005	.031	-.150	.161	.047	.091	.048
NEW ACCOUNTS	1085	.169	.225	.227	-.008	.105	.042	.272	.113	.525	.259	.491	.237
POSTAGE COST	1109	.083	.109	.114	-.116	.191	-.021	.253	.175	.401	.129	.2983	.115
SUPPLIES	1112	-.212	.137	.076	-.174	-.120	-.011	.080	-.050	.207	.100	.245	.094
COMMODITY TRNS	1083	.594	.422	.164	.354	.151	.425	.259	.077	.232	.432	.309	.431
COMMODITY INCH	1095	.641	.480	.204	.449	.248	.511	.316	.189	.275	.470	.365	.473
OVERLIN ACCTS	1034	.068	.089	.021	-.005	.049	.046	.000	-.025	-.011	.107	.034	.104
GIVEUP INCH	1097	-.077	.142	-.002	-.074	.067	.090	-.037	-.099	-.054	.136	.022	.157
OPS PSNL EXP	73	.054	.293	.175	.104	.036	.254	.222	.113	.162	.243	.254	.280
OP MNGR EXP	99	.068	.151	.135	.098	-.083	.156	.113	.087	.063	.129	.098	.154
RETAIL INCH	1004	.061	.263	.186	.135	-.011	.218	.206	.081	.189	.283	.189	.285
TICKERS/NEWS	1111	.421	.349	.258	.411	.405	.346	.272	.261	.266	.315	.308	.325
QUOTATN COST	1116	.380	.265	.222	.398	.390	.375	.205	.183	.197	.269	.197	.257
# SALES ASST	1119	.409	.464	.193	.412	.537	.480	.325	.224	.318	.451	.427	.454
TRAVEL EXPS	1019	-.095	.109	-.059	-.031	-.260	.075	-.049	-.347	-.121	.115	.038	.102
MKTTRNSOFFBD	1081	.333	.455	.409	.201	.519	.316	.518	.423	.637	.452	.550	.459
#OFFCES/MSA	1066	.075	-.011	.108	.059	.318	-.028	.111	.291	.128	.001	.039	-.003
CORRECTIONS	1022	.474	.472	.344	.454	.431	.501	.315	.128	.313	.484	.442	.500
REC-T ERRORS	1023	.490	.445	.407	.406	.542	.448	.419	.309	.443	.425	.398	.436
GSD INCOME	1100	-.121	.155	-.146	-.061	-.127	.025	-.144	-.260	-.105	.142	.208	.144
OFFMNGR EXP	67	.017	.043	.075	-.074	-.089	-.014	.066	.093	.070	.071	.098	.064
AGE OF OFFCE	1063	.253	.336	.378	.046	.024	.276	.484	.299	.483	.375	.450	.369

Table 1 continued

	1101	1104	1106	1107	1108	1011	1016	1082	1090	1004	1104	1024	1070
INT ON CASH	1104	.583											
OTASUP MONEY	1106	.580	.558										
INC-DEBITS	1107	.597	.305	.689									
INTER ON CRD	1108	.717	.448	.566	.603								
BANK VOLUME	1011	.675	.441	.438	.266	.445							
DEALER VOLUME	1015	.200	-.027	.103	-.118	-.001							
MKTNETTRANS	1082	.429	.112	.046	-.071	.272	.551						
MARKETNETINC	1090	.482	.259	.081	-.075	.252	.601	.799					
# OPS PERSONS	1094	.551	.441	.382	.111	.415	.613	.629	.574				
OPS SALARIES	1105	.632	.434	.464	.291	.474	.507	.480	.479	.917			
ADVERTISING	1024	-.057	-.040	.093	.073	-.118	.015	-.074	-.024	.014	-.010		
AE'S LSS YR	1070	-.498	-.318	-.225	-.192	-.492	-.150	-.369	-.342	-.287	-.326	.386	
TOT AE CHNGE	1072	-.395	-.259	-.108	-.102	-.400	-.124	-.338	-.264	-.214	-.272	.405	.769
SALES PROMOS	1025	.080	.207	.122	-.063	.109	-.028	.047	.058	.100	.025	.163	.021
NEW ACCOUNTS	1085	.208	.356	.257	.061	.266	-.243	.160	.113	.067	.079	.006	-.152
POSTAGE COST	1109	.106	.244	.134	-.111	.140	.046	.112	.013	.211	.185	.174	-.091
SUPPLIES	1112	.146	.242	.116	-.173	.144	.187	.353	.248	.381	.293	.080	-.098
COMMODITY TRNS	1083	.422	.236	.288	.412	.311	-.004	.069	.071	.015	.049	-.122	-.212
COMMODITY INCM	1096	.478	.298	.380	.500	.366	-.035	.066	.068	.181	.175	-.090	-.188
OVERIM ACCTS	1034	.086	-.159	-.128	.086	.023	.024	-.067	-.114	-.196	-.097	-.123	-.101
GIVEUP INCOME	1097	.131	.027	-.042	.050	.020	.028	-.019	-.034	-.041	.070	-.112	-.085
OPS PSM EXP	73	.261	.051	.055	.195	.215	.189	.223	.203	.057	.157	-.203	-.237
OP MGR EXP	99	.131	-.105	-.110	.007	.168	.056	.144	.172	.020	.058	-.193	-.236
RETAIL INCOME	1004	.258	.116	.020	.079	.131	-.032	.156	.219	.104	.110	-.065	-.151
TICKERS/NEWS	1111	.337	.258	.542	.582	.327	-.087	-.105	-.112	.026	.169	.122	-.022
QUOTATN COST	1116	.180	.202	.436	.450	.211	.120	-.185	-.172	.077	.216	-.001	-.104
# SALES ASST	1119	.454	.419	.521	.399	.354	.398	.188	.178	.480	.506	.178	-.005

Table 1 continued

	1101	1104	1106	1107	1108	1011	1016	1082	1090	1004	1104	1024	1670
TRAVEL EXPNS	1019	.112	.010	-.126	-.227	.026	.238	.266	.139	.168	.157	-.065	-.132
MATTINSOFFED	1081	.422	.435	.641	.674	.379	.080	-.176	-.032	-.125	.172	-.027	-.182
OFFICES/SMSA	1066	.000	.083	.157	.258	-.112	-.212	-.126	-.259	-.267	-.083	.102	.137
CORRECTIONS	1022	.481	.582	.587	.418	.266	.380	.026	.021	.204	.253	-.133	-.293
REG-T ERRORS	1023	.430	.476	.611	.635	.424	.115	-.166	-.214	-.087	.158	.012	-.103
CSD INCOME	1100	.178	.182	.067	-.158	.034	.431	.324	.410	.683	.305	.004	-.146
OFFICER EXP	67	.026	-.053	.004	-.017	.148	-.011	-.084	.003	.069	-.055	-.137	-.191
AGE OF OFFCE	1063	.302	.122	.031	.150	.340	.082	-.089	.194	.178	.042	-.191	-.316

Table 1 continued

	1072	1025	1085	1109	1112	1083	1096	1034	1097	73	99	1004	1111
TOT AE CHNGE	1072												
SALES PROMOS	1025	.047											
NEW ACCOUNTS	1085	-.178	.293										
POSTAGE COST	1109	-.127	.401	.441									
SUPPLIES	1112	-.020	.574	.275	.482								
COMMODITY TRNS	1083	-.172	-.021	.072	-.087	.009							
COMMODITY INCH	1096	-.125	-.043	.045	-.087	-.009							
OVERIM ACCTS	1034	-.151	-.072	-.029	-.020	.174	-.042						
GIVEUP INCOME	1097	-.145	.057	-.008	-.094	.118	-.064	.775					
OPS PSNL EXP	73	-.214	.026	-.045	-.048	.170	.128	.144	.107				
OP MGR EXP	99	-.212	-.082	-.104	-.106	.072	.063	.012	-.054	.473			
RETAIL INCOME	1004	-.131	.080	.076	-.021	.031	.052	.073	.160	.102	.051		
TICKERS/NEWS	1111	-.012	.041	.179	.021	.015	.422	-.094	-.047	.076	-.049	-.037	.504
QUOTATN COST	1116	.004	.093	.100	.087	.038	.169	-.038	-.053	.011	-.023	-.032	.334
# SALES ASST	1119	.063	.115	.117	.248	.135	.309	-.083	-.066	-.122	-.100	.000	.139
TRAVEL EXPNS	1019	-.105	.155	-.011	-.057	.266	.175	.204	.171	.078	.039	.118	.381
MKTTRNSOFFRD	1081	-.180	.003	.406	.240	.070	.256	.160	.174	.164	-.074	.062	.275
#OFFCES/SMSA	1066	.117	-.122	.014	.016	-.152	.018	-.042	.024	-.033	-.160	.007	.368
CORRECTIONS	1022	-.197	-.087	.243	-.052	-.057	.357	-.098	.003	.004	-.125	.027	.429
REC-T ERRORS	1023	.011	.154	.219	.038	.079	.310	-.066	-.030	.097	-.151	-.059	.009
GSD INCOME	1100	.007	.121	.039	-.068	.254	.012	-.187	-.069	.059	.034	.038	.059
OFFMGR EXP	67	-.201	-.175	-.066	-.016	-.064	-.032	.071	-.063	.232	.280	-.013	.065
AGE OF OFFCE	1068	-.390	-.212	.116	.088	-.040	.184	.120	-.012	.399	.218	.151	

Table 1 continued

	1116	1119	1019	1081	1066	1022	1023	1100	67	1068
QUOTATN COST	1116									
# SALES ASST	1119	.309								
TRAVEL EXPNS	1019	-.082	-.001							
MTTRNSOFFND	1081	.184	.164							
OFFCES/SHSA	1066	.134	.030	.664						
CORRECTIONS	1022	.291	.410	.297	.073					
REG-T ERRORS	1023	.654	.229	.496	.224	.465				
GSD INCOME	1100	-.161	.203	-.182	-.121	.208	.001			
OFFMGR EXP	67	-.000	-.112	.045	-.091	.016	-.051	.112		
AGE OF OFFICE	1068	-.073	-.064	.303	-.020	.070	-.045	-.045	.374	

good fit of one factor solution to the other. This provides some assurance that the factor solution is reliable and stable, despite the relatively small ratio of cases to variables.

An examination of Table 2 shows several phenomena of interest. First, the large first factor captures overall volume of transactions, which is a primary goal for a retail brokerage office. This factor is comprised of a number of volume indicators and volume by-products. Factors 2, 6, and 9 capture the variance attributable to specific types of intermediate volume goals which contribute to overall volume. Volume of institutional income, commodity income, and large individual accounts are distinguishable operative goals to which the brokerage office attends. What is noteworthy about these goals is that they are distinct, replicable factors. One possible interpretation is that these factors indicate distinct office response to current environment and market conditions. The office, in effect, has a primary goal of pursuing high overall volume (factor 1). The securities environment and the customer environment present somewhat different demands and opportunities to the office (factors 2, 6, and 9) which the office attempts to meet. These types of volume are best thought of as mutually compatible, possibly mutually reinforcing, subgoals for achievement of the primary goal, overall volume.<sup>3</sup>

Let us turn now to what we would term the instrumental goal factors. We see that factors 3, 7, and 11 are best described as level of account executive experience, level of operations experience, and level of administration experience respectively. These three factors are indicative of personnel goals which are instrumental for enhancing overall volume and production. We would construe them as conditions which each office would like to enhance in order to be capable of responding better to the demands of the customer and market environment. The loadings in the factor matrix of the high loading variables for these three factors with factor 1 provide some support for this observation. They indicate that an office can in part control its level of performance by having a higher level of broker operations and administrative experience.

The magnitude of these experience factor effects may be attenuated by the nature of the effects of experience in the context of factor analysis. Tripathi (1972) points out that the pattern of account executive performance is an S-shaped function where initial performance is low and stable, then after some period of time, becomes positively accelerated for a period of time up to 7-8 years experience. At that point performance typically levels off and the slope of the performance curve returns to approximately zero. If this type of curvilinear S-shaped function is a correct characterization of the pattern of account executive performance, then the

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<sup>3</sup> A brief analysis using multiple regression lends support to this mutual reinforcement view. Total production income was regressed on total accounts (expressed as a product term). The interaction term was significant in this analysis, using the increment in  $R^2$  test advised by Cohen and Cohen (1975). This is an indication of the fact that a mix of goal pursuits is, in total production terms, a mutually reinforcing strategy.

Table 2  
Factor Matrix of Brokerage Office Performance Indicators for 1969

Variable	Number	1 - Overall	2 - Institution	3 - Experience of Brokers	4 - Promotion of New Customer	5 - Level of Office Business	6 - Large Individual Account Volume	7 - Operations Inexperience	8 - Level of Retail Service	9 - Commodity Volume	10 -	11 - Administrative Experience
FLR BRKR INC	1006	.694	-.226	.028	-.114	.037	-.052	-.147	.306	.41	-.090	.110
AVAILABLE INC	1007	.884	.321	.076	.042	.008	.089	.111	.111	.16	.134	-.034
INDIVIDUL VOL	1010	.753	-.105	.143	.029	-.119	-.064	.074	.023	-.08	-.018	.030
PENSION LINCH	1014	.612	.140	-.066	-.316	.049	-.016	.010	.381	.20	-.005	-.170
TELEGRAM EXP	1020	.502	.087	-.145	-.082	-.344	.118	-.215	.475	.02	-.124	.069
OVER IM COMM	1035	.820	.227	.027	-.152	.098	.055	.080	.265	.18	.076	-.108
5H-1M TOTACT	1040	.889	.032	.109	.145	-.141	-.075	.037	-.050	.02	-.135	.085
MARGIN ACCTS	1086	.611	-.007	.079	-.019	-.362	-.154	.031	.039	-.08	-.408	.157
1H-5H TOTACT	1046	.827	.004	.113	.370	-.337	-.080	-.027	-.050	.02	-.106	.151
NEW ACCT COM	1062	.895	.263	.074	.034	.019	.101	.053	.074	.16	.145	.014
TOT TRANSACT	1077	.792	.309	.168	.264	-.126	.001	.012	-.007	.21	.119	.170
ONBOARD INCH	1088	.919	.122	.072	.006	-.069	.073	.036	.241	.03	-.035	.043
TOTPROD INCH	1091	.903	.260	.092	.024	.012	.106	.073	.086	.15	.157	-.000
SEC&COMM INC	1101	.837	.314	.060	.043	.003	.089	.068	.076	.19	.180	-.044
INT ON CASH	1104	.545	.091	.140	.289	-.134	-.070	-.245	.205	.05	.365	-.053
OT&SUP MONEY	1106	.570	.146	-.063	.100	-.173	-.087	-.114	.539	.12	.172	.007
INC-DEBITS	1107	.678	-.073	-.147	-.202	-.225	.042	.106	.452	.23	-.053	-.069
INTER ON CRD	1108	.800	.116	.121	.144	.059	-.054	.123	.124	.07	-.073	.107
BANK VOLUME	1011	.487	.563	.010	.019	.223	.167	.013	.095	-.04	.382	-.084
DEALER VOLUM	1016	-.103	.843	.062	-.068	.125	.095	.016	.083	.02	-.020	-.019
MTNETTRANS	1082	.223	.724	.122	.139	.167	-.057	.144	-.359	.04	.179	-.005

Table 2 continued

MARKETING	1090	.298	.553	.042	.043	.266	-.115	.122	-.328	-.01	.510	.018
# OPS PERSONNEL	1094	.365	.799	.041	.155	-.037	-.118	-.075	.021	-.07	.092	-.071
OPS SALARIES	1105	.458	.778	.056	.081	-.197	.005	-.002	.120	-.06	.043	-.027
ADVERTISING	1024	.023	.024	-.792	.123	.009	-.065	-.145	-.016	-.07	-.049	.027
AE'S LSS 1 YR	1070	-.441	-.185	-.691	-.053	-.126	-.035	-.101	-.005	-.01	-.057	-.099
TOT AE CHNGE	1072	-.381	-.137	-.726	-.055	-.082	-.098	-.061	.111	-.00	.055	-.145
SALES PROMOS	1025	.010	-.022	-.142	.748	.205	.026	.112	.164	-.04	.080	-.313
NEW ACCOUNTS	1085	.289	-.177	.116	.622	-.121	-.019	-.229	-.084	.02	.208	.100
POSTAGE COST	1109	.140	.134	-.044	.714	-.040	-.016	-.210	.005	-.09	-.274	.216
SUPPLIES	1112	-.033	.334	-.015	.783	.093	-.041	.119	.030	.03	.053	-.094
COMMODITY TRNS	1083	.290	-.036	.080	-.016	.065	.108	.040	.051	.91	.046	-.016
COMMODITY INCM	1096	.348	.018	.037	-.060	.000	-.093	.014	.140	.88	.030	-.045
OVERHEIM ACCTS	1034	.061	-.092	.053	-.58	.081	.907	.046	-.050	.06	-.149	.112
GIVEUP INCOME	1097	.045	.007	.069	-.004	.024	.923	.020	-.023	-.02	.084	-.121
OPS PSNL EXP	73	.170	.098	.114	.030	-.088	.129	.775	.010	.09	.084	.112
OP MGR EXP	99	.109	.055	.150	-.113	.169	-.115	.672	-.033	.00	-.105	.159
RETAIL INCOME	1004	.359	-.073	-.033	-.013	.029	.126	.172	-.328	-.12	.196	-.374
TICKETS/NEWS	1111	.280	-.063	-.168	.061	-.256	-.063	.091	.529	.32	.119	.117
QUOTATN COST	1116	.227	-.015	.016	.057	-.010	-.024	.051	.752	-.02	-.102	-.614
# SALES ASST	1119	.395	.411	-.107	.057	.036	-.053	-.320	.346	.15	.010	.102
TRAVEL EXPNS	1019	-.014	.179	.032	.143	.637	.235	.058	-.132	.16	.182	-.057
WKTTRNSOFFBD	1081	.453	-.049	.066	.254	-.684	.211	-.011	.095	.12	.017	.119
#OFFCES/SHSA	1066	.013	-.063	-.115	-.018	-.829	.025	-.019	.022	.02	-.009	-.082
CORRECTIONS	1022	.410	.047	.219	-.107	-.105	-.048	-.312	.397	.15	.494	.062
REC-T ERRORS	1023	.443	-.172	-.011	.146	-.280	-.052	-.005	.558	.07	.193	-.127
GSD INCOME	1100	-.068	.389	-.064	.073	.152	-.123	.034	-.067	.04	.724	.152
OFFMGR EXP	67	.045	-.089	.099	-.073	.072	-.002	.379	.033	-.11	.153	.738
AGE OF OFFICE	1068	.417	-.071	.171	.001	-.087	.010	.273	-.160	.14	-.009	.447

magnitude of factor loadings of experience variables on the office volume factors should be lower since factor analysis is insensitive to nonlinear and interactive relationships.

There is a second set of instrumental factors in the factor matrix which may be labelled conditionally instrumental goals for the brokerage office. By conditionally instrumental we mean goals that, if chosen, will not necessarily have a direct positive impact on all the other instrumental goals and the factor 1 goal of increased volume. The office, through some process of choice, can pursue the goal if it chooses to use that goal as an instrumental path to the achievement of some other goal, or it can take some alternative path. The choice of pursuing these goals involves tradeoffs, weighing the costs incurred and benefits accrued by choice of a particular path. The three factors which fall in this category are factor 4 (promotion of new business for the office), factor 8 (level of retail service, and factor 5 (level of interoffice business).

These three factors all capture strategic choices the office must confront about how it will operate. Factor 4 captures the concept of expending energy to promote new business for the firm. Some offices may concentrate their energies on developing and expanding the amount of business they derive from their current customer base, while others choose to actively concentrate on seeking new customers. The optional nature of these choices can be seen in the low loadings of the defining factor 4 variables on factor 1, and the defining factor 1 variables on factor 4. In effect, the choice involves considerations which are not necessarily expressed directly in organization performance.

In the case of factor 8, the choice confronting the office is what level of customer service to maintain. While empirically, the factor analytic definition of this variable is weak, the factor can be given a reasonable interpretation within the goal framework. When the firm chooses to increase the level of retail service, this has a positive relationship to overall (factor 1) and institutional (factor 2) volume, but the cost of increased service reduces by the level of net retail income, which loads negatively on this factor. Since the cost of retail service is absorbed by the accounting category of retail income, the office has, in effect, opted for increasing current business, possibly at a cost to the base for financing retail service costs (i.e., the retail income category). While this may seem like an example of capturing the accounting structure in a factor analysis, the accounting structure is a real control system which does influence how funds are budgeted and allocated.

A second, compatible, interpretation of the loadings on factor 8 is that office members have chosen to respond to decreased retail income by increasing retail services, which has an effect on all types of business, not just the retail business. The other option available to the office is cost cutting which will cut into the costs absorbed by the retail income category, increasing retail income at some detriment to overall

volume. While these are admittedly speculative conjectures which require additional analyses beyond our current data set capacity, they seem plausible, particularly in light of the analyses presented later in this paper.

Factor 5 represents, in our interpretation, a third set of choices. The choice for the office here is how much inter-office business they want to engage in. An office can choose to try to execute all business within its own regional boundaries, or it can take on business which requires the sharing of transactions, at some cost, with other brokerage offices in the brokerage system. Both options incur costs; the former (internal executions) in the development and maintenance of structures and resources to absorb business, and the latter (external executions) in the reduced revenues of shared transactions and the transaction costs themselves. In examining the pattern of loadings, this choice (internal vs. external executions) seems less trying and fraught with difficulties than the other conditionally instrumental goals, since the factor appears distinct, and shows relatively slight relationships with other variables.

Factor 10 is the only factor which we have not interpreted here. We are frankly puzzled by this factor, which does not lend itself to clear interpretation. A high score on this factor would indicate low error costs, a higher level of margin accounts (which tend to be more speculative trading accounts), and a low level of income of government securities dealings. "Error Costs" include some reimbursements paid to customers for market losses arising from delayed or incorrect transactions, and the amounts are not trivial. Such errors are more likely to occur in connection with speculative trading. How government security transactions enter the picture is not evident to us. Most of these variables show strong, interpretable loadings on other factors. Although we could attempt a speculative interpretation of factor 10, it would not be very consistent and would engender little confidence in either ourselves or the reader. To paraphrase mathematics texts, we leave the interpretation, as an exercise, to the reader (no correct answer).

#### Discussion

The analysis of the performance data reveals several properties of organizational performance in these brokerage offices.

We can see that the dimensions of office performance can best be understood in a goal achievement framework. We have distinguished three classes of goals. The first class is the end state goal of volume of production and the various contributing factors which are intermediate volume goals that contribute to achievement of the end state. The second class we have labeled instrumental goals, which are means for achievement of the volume goals. The third class of goals were termed conditional instrumental goals. These can be thought of as strategic choices with costs and benefits for each choice with only indirect effects on the primary goals.

There are several observations we have noted in these results. The fact of multidimensional results is somewhat noteworthy since we are dealing with a rather simple task technology for organizations. There is no good a priori reason to think that various groups of customers would be relatively independent. One could easily imagine an office where transactions with one group are made at the expense of attention to other groups, leading to a single volume factor with positive loadings for some groups and negative loadings for others. Clearly, we are seeing that goal differentiation is in part a response to the differentiation in the market place of customers. Similarly, the differentiation of personnel functions (the basis for the instrumental goals) and the strategic or conditionally instrumental goals reflect a differentiation of the environment and paths in the environment.

The goal achievement model dominance of the performance dimension also reflects the manner in which the organization's accounting control system has been designed to process information about office functioning. The argument for this observation was presented earlier in this paper. What is noteworthy about this is not that, given the initial framework within which the data were collected, goal orientation dominates the results, but that we can still detect elements of environmental responsiveness (which fits into a systems orientation) and strategic decision-making factors (which fit into a decision-making view of effectiveness).

#### COMPATIBILITY OF ALTERNATIVE VIEWS OF EFFECTIVENESS

The second question we examine empirically is the compatibility of the three effectiveness models most widely employed in organizational behavior--the natural systems model, the goal model, and the decision-making model.

One of the concerns that motivated our whole research effort on the concept of organization effectiveness was how these three conceptually distinct views of effectiveness were related. The first set of indices we have generated from the factor analysis of performance provides us with a useful array of goal achievement effectiveness indicators. What we now want to do is examine how these goal indicators are related to variables which measure aspects of decision making and open system effectiveness. The correlations between these sets of indicators derived from the three effectiveness approaches should give us an idea of how reinforcing, independent or conflicting the three approaches are, relative to each other.

#### Method

In forty of the brokerage offices, data about system properties and decision making were collected using questionnaires. Offices were chosen using the following sampling criteria. Twenty four offices were relatively large (35 or more account executives) while 16 offices were relatively small (20 or fewer account executives). Only offices with a stable management (defined as offices with the same office manager for at least two years) and stable territorial boundaries were selected. Finally, half of

the offices showed above average performance, as defined by the firm,<sup>4</sup> and half showed below average performance. The forty-office sample, while not representative, does capture variance in terms of size and performance, with no confounding effects due to changes in upper level management. Data were collected using questionnaires administered by mail. Half the respondents in each office received the Survey of Organizations (SOO), a standardized Institute for Social Research questionnaire (Taylor and Bowers, 1971). The other half of the respondents received a questionnaire specifically designed for the study (SRC questionnaire), incorporating a set of measures derived from an open system model and from prior work on leadership and participation in decision making. The respondents (the account executives/stockbrokers) gave an 88% response rate to the surveys, which is quite high by mail survey research standards.

Using the scaling analyses of these data by Tripathi (1972), a number of scales were constructed from the survey data (the scales are described in Appendix II). For a more detailed presentation of the items, scaling procedures, results, and scale characteristics, see Tripathi (1972). The scales were then aggregated at the office level. Tripathi showed that aggregation of these individual responses was defensible since the between-office variance was significantly greater than the within-office variance for most of the scales in a one-way analysis of variance across offices.

Goal achievement scores were calculated by constructing factor composites using the procedure outlined by Rummel and attributed to Cattell. Briefly, factor composite scores were constructed by taking the variables which distinguished the factor (i.e., high loading variables) and showed low loadings varying in sign on the other factors, weighting them by their factor loadings, and adding them up.

The factor composites for both 1968 and 1969 were correlated with the aggregated survey scales. Since the survey scales were constructed from data collected in 1969, the primary attention was to the correlations with the 1969 factor composites. The 1968 factor composite correlations were also examined in order to obtain some idea of the stability of the relationships observed.

### Results

The correlations, displayed in Table 3, show an interesting pattern of results. The systems scales and decision making scales both show a number of significant, though moderate, relationships with factors 8 and 5 and to a lesser extent, factor 4. Although there are significant correlations

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<sup>4</sup>The office performance index was designed to represent the business volume of an office, relative to all other offices, adjusted for job experience of account executives and office size.

Table 3  
Correlations of 1968 and 1969 Factor Composites with System and Decision-Making Properties

SYSTEM SCALES	1 - Overall Volume	2 - Institution Volume	3 - Experience of Brokers	4 - Promotion of New Customer Business	5 - Level of Interoffice Business	6 - Large Individual Account Volume	7 - Operations Inexperience	8 - Level of Retail Service	9 - Commodity Volume	11 - Administrative Experience
Pay Satisfaction	.30	.18	.23	-.09	.28	.22	-.18	-.33*	.12	.09
	.06	.03	.17	-.41**	.32*	-.04	-.27	-.36*	.10	.12
Motivation	.03	.10	.01	-.29	.44**	.17	.03	-.51**	.21	-.15
	-.05	-.14	-.08	-.32*	.42**	.00	-.10	-.38*	.15	-.15
Technological Adequacy	-.12	.08	-.00	-.27	.49**	-.16	-.07	-.19	.28	-.04
	-.06	.00	.25	-.30	.54**	-.08	-.05	-.25	.20	-.16
Supervisor Satisfaction	.12	.20	.17	-.24	.36*	.20	-.19	-.43**	.12	.05
	.02	-.02	.14	-.34*	.36*	.16	-.24	-.45**	.00	.08
Trust	.13	.19	.05	-.23	.26	.20	-.13	-.25	.18	.07
	.04	.04	.19	-.37*	.29	.13	-.15	-.41**	.11	.01
Supervisor Support	.13	.22	.12	-.25	.25	.29	-.14	-.43**	.13	.04
	.02	.01	.09	-.37*	.26	.11	-.16	-.48**	.09	.06
Supervisor Interaction Facilitation	.00	-.01	-.00	.10	.27	.14	.09	-.32*	.14	-.28
	-.01	-.12	.09	-.02	.18	.02	-.10	-.33*	.09	-.26
Supervisor Work Facilitation	.01	-.03	.04	-.20	.40*	.17	-.17	-.47**	.28	-.10
	.03	-.18	.16	-.31*	.42**	.02	-.27	-.35*	.17	-.06
Supervisor Goal Emphasis	.11	.08	.14	-.17	.28	.25	-.13	-.34*	.20	-.11
	.10	-.07	.03	-.31*	.31*	.04	-.29	-.29	.01	-.14
Office Satisfaction	-.08	-.06	.00	-.43**	.36*	.02	-.28	-.26	.05	.06
	-.01	-.12	.32*	-.43**	.38*	.04	-.22	-.29	.07	.19

Table 3 - (cont'd)

SYSTEM SCALES	1 - Overall Volume	2 - Institution Volume	3 - Experience of Brokers	4 - Promotion of New Customer	5 - Level of Business	6 - Large Individual Account Volume	7 - Operations Experience	8 - Level of Retail Service	9 - Commodity Volume	11 - Administrative Experience
Conflict Handling	.02 -.02	-.16 -.24	.07 .05	-.31 -.46**	-.01 .11	.24 .19	-.25 -.18	-.29 -.29	.09 .10	.00 -.00
Intergroup Coordination	.05 .01	.00 -.08	.07 .12	-.26 -.41**	.03 .13	.23 .11	-.22 -.20	-.32* -.33*	.12 .20	-.10 -.11
Group Method Supervision	-.07 .00	.01 -.06	.12 .29	-.12 -.23	.36* .33*	-.02 .12	-.12 -.20	-.32* -.44**	.17 .09	-.13 -.08
Communications	.00 -.04	.04 -.07	.10 .24	-.17 -.29	.31 .38*	.13 -.01	-.22 -.20	-.37* -.36*	.28 .19	.06 .04
Peer Interaction Facilitation	.06 -.01	.12 -.00	.15 -.00	.10 -.08	.20 .21	.11 .01	.12 .04	-.37* -.27	.09 .00	-.29 -.28
Peer Work Facilitation	.00 -.04	.05 -.12	.10 -.01	.04 -.09	.28 .30	.01 -.03	.01 -.11	-.48** -.36*	.27 .06	-.27 -.28
Peer Goal Emphasis	.12 .05	.15 .05	.20 .08	-.15 -.28	.28 .29	.14 .02	-.01 -.06	-.36* -.41**	.12 .09	-.04 -.19
Peer Support	-.00 -.07	.34* .14	-.00 -.09	-.15 -.32*	.25 .24	.14 .03	.15 .14	-.32* -.24	-.03 -.08	-.23 -.27
Teamwork and Cooperation	.03 -.04	.22 .13	-.04 -.09	-.07 -.22	.12 .16	.22 -.00	.03 -.06	-.65** -.33*	.20 .22	-.34* -.24
Information Exchange	-.24 -.07	.11 .17	-.22 .11	-.01 -.08	.30 .38*	-.24 -.03	.11 -.23	-.19 -.27	.01 .01	-.48** -.46**
Supervisor Style	-.16 -.16	-.02 -.04	-.19 -.03	-.17 -.20	.26 .30	.09 .09	-.15 -.40*	-.44** -.32*	.22 .21	-.33* -.21

Table 3 - (cont'd)

	1 - Overall Volume	2 - Institution Volume	3 - Experience of Brokers	4 - Promotion of New Customer Business	5 - Level of Interoffice Business	6 - Large Individual Account Volume	7 - Operations Inexperience	8 - Level of Retail Service	9 - Commodity Volume	11 - Administrative Experience
Adequacy of Information <sup>b</sup>	-.45**	-.06	-.15	-.21	.24	-.24	-.30	-.27	.31	-.31
	-.22	-.02	.01	-.20	.35*	.10	-.46**	-.22	.19	-.28
DECISION SCALES										
Subordinate Control	-.17	.08	.13	.04	.41**	-.14	-.16	-.32*	.09	-.20
Over Supervisor	-.03	.08	.25	-.00	.16*	.04	-.27	-.30	-.01	-.19
Control (SRC)	-.13	.17	.09	-.03	.18	-.18	.24	-.24	.14	-.40*
	-.08	.18	.09	.03	.17	.08	.02	-.33*	.29	-.28
Delegation (SRC)	.02	.07	-.04	.10	.26	-.01	-.15	-.26	.32*	-.01
	-.06	.06	.03	.03	.31*	-.18	-.07	-.22	.09	-.03
Control (S00)	.08	.22	-.00	-.11	.19	-.14	-.04	-.20	.31*	-.02
	-.07	.05	-.02	-.13	.19	-.12	-.14	-.14	.19	-.06
Decision Making Down (S00)	.02	.04	.06	-.15	.36*	.06	-.19	-.30	.24	.01
	.09	-.09	.29	-.24	.15*	.07	-.18	-.36*	.15	-.00
Supervisor Upward Influence	-.08	-.00	-.10	-.19	.31*	-.03	-.38*	-.12	.13	.11
	.03	-.02	.13	-.32*	.41**	.10	-.48**	-.21	-.01	-.00

NOTE: Upper correlation with a factor is for scale correlation with 1968 factor composite, and the lower correlation is with the 1969 factor composite.

a \* -p < .05 \*\* -p < .01

b Adequacy of Information is measured using questions pertaining to information presented in meetings. We suspect that meetings and volume of information are positively related, and meetings may be responses to poor performance. This would explain the anomalous finding that adequate information is related to poor performance and the inexperience of operations personnel.

with other factors, they are infrequent and unstable across time. Consequently, we regard them as due to chance. We will concentrate on the clear patterns of significant correlations on factors 4, 8, and 5, the conditionally instrumental goals.

Factor 4 (promotion of new customer business) generally shows negative correlations with system properties (12 out of 44 correlations significant) and no relationship with decision-making properties. Recalling our characterization of factor 4 as a conditional instrumental goal, we would interpret this pattern of correlations to indicate that office administrators choose to promote new business externally when system conditions are relatively poor. Conversely, when systems conditions are good, the need to promote business externally is lower since the system conditions are more conducive to promotion of business using the current customer base. In effect, system conditions feed into the choice of this conditionally instrumental goal for the office. In drawing this interpretation and others, the reader should be mindful of the ambiguity of causality in the interpretation of correlations. For example, one could interpret the correlations of factor 4 composites with system properties to indicate that the promotion of new business results in the deterioration of system conditions.

Factor 8 (level of retail service) shows a strong pattern of negative correlations with system conditions (30 significant negative correlations out of 44) such that better system conditions are indicative of higher levels of retail income and lower levels of service costs. We interpret this pattern as indicating that better system conditions allow for more effective utilization of retailing resources and improved retailing performance. In effect, the choice of whether to allocate more resources to retailing is obviated when the system is in good condition. On the other hand, poor system performance contributes to the need to decide on how to allocate resources for the purpose of improving retail service and income. The decision-making scales show a weaker, but similar pattern of negative correlations. Increased subordinate influence and control positively covaries with retail income and negatively covaries with the level of retail services. Our interpretation here is that as decision making concerning retailing decisions is vested in the account executive, resources are utilized more effectively and consequently retail income is increased. The level of flexible responsiveness to customer demands should be enhanced by increasing account executive discretion and influence with the office manager.

Factor 5 (level of inter-office business) shows an intermediate pattern of positive correlations (17 significant positive correlations out of 44) indicating that improved system conditions negatively covary with the amount of inter-office business and outside relationships. In effect, the choice of whether to develop inter-office transaction activities is in part conditional on internal system capacity. Higher levels of the system properties indicate a greater capacity to respond to uncertainty in the environment. In effect, greater system capacity allows the office to handle more

of its business internally. The decision-making scales also show the positive correlation pattern, indicating that greater subordinate control and influence reduces the need to export business or seek less valued import business. In the decision-making domain, supervisor influence upward, and internal delegation seem more critical to reduced inter-office business than perceived subordinate upward influence.

What is interesting to note about these correlation patterns is that system effectiveness and decision-making properties are substantially relating only to conditional instrumental goals that are in the strategic decision-making domain, while they are most weakly related to the primary goals of volume and weakly related to the instrumental demographic goals (various classes of member experience). That is, system and decision-making effectiveness facilitates the pursuit of discretionary goals, while the instrumental and primary goals are more responsive to market and environmental forces. There do seem to be, however, weak effects of the demographic, instrumental goal factors on system and decision-making effectiveness. Factor 7 shows mostly negative correlations with system properties, indicating that the more inexperienced operations personnel are, the poorer decision effectiveness. Our conclusion from this evidence supports our characterization of factor 7 as an instrumental goal. Increased member experience, essentially operations staff tenure, is an unconditionally desirable goal because it enhances the capacity of offices to respond to the market place and of operations personnel to support brokerage activities and decision making. To illustrate, supervisors will probably be leery of delegating responsibility when operations personnel are inexperienced and have not demonstrated a capacity to handle those responsibilities.<sup>5</sup>

A final conclusion we would draw is that the systems, decision-making, and goal achievement approaches to organizational effectiveness are essentially compatible in these organizations. That is, systems and decision-making variables (in findings reported by Tripathi) are compatible and both are compatible (being either independent of or mutually reinforcing) with goal achievement.

When one considers that these correlations were calculated using different data sources (eliminating methods variance) and that the correlation patterns fit the earlier distinctions from the performance dimensions analyses, we are fairly confident about the validity of these results for this sample of brokerage offices. Our confidence is further bolstered by the similarity of these results to those of Seashore and Yuchtman (1967)

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<sup>5</sup>One curious set of results is that administrative experience (factor 11) is negatively related to information exchange and teamwork and cooperation. Our assumption is that office managers may, with increased experience (or with more traditional norms, which are probably confounded in these stable offices with increased experience), be less disposed to interacting with subordinates and providing and exchanging work related information. This is only a speculative explanation, and may require further analysis.

in their factorial analysis of organizational effectiveness in 75 insurance agencies. They also obtained a factor for business volume (factor 1), production costs (factor 8), business mix and market penetration (akin to the secondary volume factors 2, 6, and 9). While using a different industry and data base of measures, their factor solution is in some conceptual and empirical respects, similar to the results we have presented.

We see these results indicating that the domains of effectiveness of systems, goal oriented, and decision-making models are partially overlapping sets, each of which covers some portion of the universe of effectiveness constructs. As a practical matter, the choice of which particular model or combination of models is to be used, is governed by the types of effectiveness issues one is concerned with addressing and solving.

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## APPENDIX I

### Office Performance Measures Definitions and Descriptions

- 1006 Floor Brokerage Department Earnings - Net income of departments' transactions done with securities on the floor of an exchange (e.g., New York or American Stock Exchange) in dollars per year.
- 1007 Available Income - The amount of income available to the office after deduction of all costs in dollars per year.
- 1010 Individual Volume - Gross income from individual customer transactions in dollars per year.
- 1014 Pension/Profit Sharing Volume - Gross income from pension and profit sharing plan customer transactions in dollars per year.
- 1020 Telegram Expenses - Total telegram expenses charged in dollars per year.
- 1035 Over 1M Accounts-Total Commissions - Total commissions in dollars per year derived from accounts generating \$1000 or more of gross income per year.
- 1040 5H-1M Total Accounts - Total number of accounts generating \$500-\$1000 of gross income per year.
- 1086 Margin Accounts - Total number of margin accounts (accounts which tend to be more speculative) per year.
- 1046 1H-5H Total Accounts - Total number of accounts generating \$100-\$500 of gross income per year.
- 1062 New Accounts-Total Commissions - Total commissions from new accounts (V1085) in dollars per year.
- 1077 Total Transactions - Total number of transactions in the office per year.
- 1088 On Board Income - Gross income from transactions done on regulated exchanges in dollars per year.
- 1091 Total Production Income - Gross income from all forms of business in dollars per year.
- 1101 Total Security and Commodity Income - Total income derived from security and commodity transactions in dollars per year.
- 1104 Interest on Cash Debits - Interest income due to outstanding customer cash debts in dollars per year.

- 1106 OT and Supper Money - Total costs for overtime and petty expenses in dollars per year.
- 1107 Income from Debit Balance - Interest income from customer debit balances on accounts in dollars per year.
- 1108 Interest on Free Credit - Income from customer funds which are currently uncommitted in dollars per year.
- 1011 Bank Volume - Gross income from bank customer transactions in dollars per year.
- 1016 Dealer Volume - Gross income from other brokerage and securities dealers transactions in dollars per year.
- 1082 Marketing Net Transactions - Net number of in house and over the counter transactions per year.
- 1090 Marketing Net Income - Income from marketing net transactions in dollars per year.
- 1094 Number of Operations Personnel - Number of operations personnel in office.
- 1105 Operations Salaries - Total cost of salaries for operations personnel in dollars per year.
- 1024 Advertising - Cost of advertising for new personnel in dollars per year.
- 1070 AE - Less than 1 Year - The number of account executives in an office with less than one year of experience.
- 1072 Total AE Change - Total number of changes in the account executive population (hires, turnover) in the office per year.
- 1025 Sales Promotion - Cost of sales promotion in dollars per year.
- 1085 New Accounts - Total number of new accounts per year.
- 1109 Postage Expenses - Cost of postage and mailing in dollars per year.
- 1112 Supplies - Cost of office supplies in dollars per year.
- 1083 Commodity Transactions - Total number of commodity transactions per year.
- 1096 Total Commodity Income - Total income from all forms of commodity business.
- 1034 Over 1M Total Accounts - Total number of accounts generating \$1000 or more of gross income per year.

- 1097 Income Received from Giveups - Income received from transfer payments from other offices in return for services rendered in placing securities for those other offices.
- 73 Average Experience of Operations Personnel - The average experience of office operations personnel in months.
- 99 Experience of Operations Manager - Number of years of tenure of operations manager in the office.
- 1004 Retail Office Income - Net income due to individual customers only (excluding institutional customers) in dollars per year.
- 1111 Tickers and News - Cost for stock ticker and news service (e.g., Dow-Jones Stock Quotation Service).
- 1116 Quotation Charges - Cost of stock quotation services in dollars per year.
- 1119 Number of Sales Assistants - Number of sales assistants (personnel who provide support services for account executives) in an office.
- 1019 Travelling Expenses - Total travel expenses charged in dollars per year.
- 1081 Marketing Transactions not on Board - Total securities transactions expected in house; number of transactions per year.
- 1066 Offices in SMSA - The number of company brokerage offices in the SMSA (Statistical Metropolitan Sampling Area).
- 1022 Correction Fees - Cost to correct errors in transaction executions in dollars per year.
- 1023 Reg-T Errors - Cost to correct errors which violate Regulation T (which requires settlement of most stock transactions in five working days) in dollars per year.
- 1100 GSD Income - Gross income derived from government security transactions in dollars per year.
- 67 Experience of Office Manager - The tenure in years of the office manager in the current office in years.
- 1068 Age of Branch - The number of years the office has been in operation.

## APPENDIX II

### Descriptions of SOO and SRC Scales

#### SOO SCALES

Pay Satisfaction - one item measure of satisfaction with pay, given the individual's level of input.

Motivation - four item measure of degree to which work and its rewards are attractive to the individual.

Technological Adequacy - two item measure of the degree to which current equipment and resources adequately support one's work efforts.

Supervisor Satisfaction - one item measure of global satisfaction with one's supervisor.

Trust - three item measure of level of trust climate in the office.

Supervisor Support - three item measure of how considerate and available for discussion the supervisor is for the respondent.

Supervisor Interaction Facilitation - three item measure of the extent to which the supervisor facilitates cohesion and communication in the work group.

Supervisor Work Facilitation - four item measure of the extent to which the supervisor provides resources and support for accomplishing work.

Supervisor Goal Emphasis - three item measure of the degree to which the supervisor sets high work goals.

Office Satisfaction - one item measure of the degree to which people are satisfied with members of their office.

Conflict Handling - two item measure of the degree to which conflicts are confronted and dealt with.

Intergroup Coordination - three item measure of the degree to which intergroup relations are confronted and dealt with.

Group Method Supervision - three item measure of the degree to which the work group is consulted in decision-making.

Communications - five item measure of how fully people are informed about events on the job and in the organization.

Peer Interaction Facilitation - three item measure of extent of team orientation towards work.

Peer Work Facilitation - three item measure of the extent to which co-workers help others do their work.

Peer Goal Emphasis - two item measure of the extent to which co-workers set high work goals.

Peer Support - three item measure of the extent to which co-workers are friendly and approachable.

Decision Making Down - five item measure of the extent of participation in decision-making.

Control - four item measure of the amount of influence groups from top management down have on events in the office.

#### SRC SCALES

Subordinate Control Over Supervisor - four item measure of extent to which subordinates have influence over supervisor decisions which affect them.

Teamwork and Cooperation - three item measure of group cohesiveness.

Information Exchange - four item measure of extent to which information about production and office operations is exchanged at meetings.

Supervisor Style - twelve item index of the extent to which supervisor structures work to facilitate performance.

Adequacy of Information - four item measure of rated adequacy of information provided about policy and production by supervisor at meetings.

Control - four item measure of amount of influence of various groups in the office on how the office is run.

Delegation - eight item measure of amount of time allocated by subordinates to management activities normally done by the office manager.

Supervisor Upward Influence - six item measure of influence of office manager with groups above the office manager level and at the office manager level.

### PART III

#### TECHNOLOGY AND ORGANIZATIONAL EFFECTIVENESS

Denise M. Rousseau and Joseph Fakhouri<sup>1</sup>

This study investigates the relation of technological characteristics to criteria of organizational effectiveness. Technology in organizations is here defined as a "mechanism" for converting inputs into outputs, the most frequently cited definition of technology in organizational research (e.g., Billings, Klimoski, & Breugh, 1977; Reimann, 1977; Rousseau, 1977). As an input-throughput-output system, an organization's technology represents a sequencing of events involving admission of inputs (e.g. raw materials, human skills, information) into the organization, conversion of these inputs into output through the application of skill and energy, and disposal of output to the environment. The characteristics of such a mechanism are likely to affect directly the end states the organization achieves.

To investigate the connection between technology and effectiveness we need to clarify what we mean by each construct. This is a difficult task because technology and effectiveness are two of the more ambiguous concepts in organizational science. Indeed, some have recommended that these concepts be abandoned. Organizational effectiveness has been criticized as having no scientific or theoretical utility (Hannan & Freeman, 1977). At least one writer (Stanfield, 1976) believes that theory and research could be improved if technology were conceptually disaggregated into discrete, homogeneous component concepts. To reduce ambiguity in the present study, we will attempt to state explicitly what we mean by technology and effectiveness and which aspects of these concepts this study explores.

#### Technology in Organizations

Part of the confusion regarding the meaning of technology in organization studies stems from a failure to recognize that technology in organizations is distinct from technology in the generic sense of the word. Technology can be generally defined as the application of knowledge to perform work (Jarvis, 1972). We speak of social technologies such as no-fault insurance, physical technologies such as the rotary engine and knowledge technologies such as operations research. Each is a special case of using knowledge to perform work or to get something done--technology in the generic sense. Technology in

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<sup>1</sup>Data for use in this study were supplied by the Commission on Professional and Hospital Activities (CPHA), Ann Arbor, Michigan. In these data, the identities of individual hospitals were not revealed in any way. Analyses, interpretations, or conclusions based on these data are solely those of the authors, and CPHA specifically disclaims responsibility for any such analysis, interpretation, or conclusion.

organizations is itself a special case. In organizations, technology represents the sequencing of activities from admission of inputs, transformation of throughputs, to the production of output--the application of knowledge regarding raw materials, transformation processes, and output. In modern society most work is done in organizations, and therefore the technology of work systems must be treated with explicit reference to organizational phenomena. Technology is shaped by the organization's need to provide its environment with a product or service in exchange for capital, fuel, and other resources. It in turn shapes the effectiveness of the organization and the behavior of its members.

Technology has been a central concept in organizational research and theory since the work of Woodward (1958, 1965). As a mechanism for transforming inputs into output, technology in organizations can be assessed by measuring input characteristics (e.g., heterogeneity), attributes of the conversion process to which inputs are allocated (e.g., automation or skill levels), and output characteristics (e.g., number of products) among others (Rousseau, 1979a). However, a recent review of conceptions of technology in contemporary research (Rousseau, 1979b) found that virtually all researchers operationalize technology in terms of characteristics of the conversion process (e.g., Bell, 1967; Form, 1973; Fullan, 1970; Hage & Aiken, 1969; Khandwalla, 1974). Past operationalizations of technology have been heavily conversion-oriented with a particular emphasis on the degree or level of automation. However, a few researchers do assess technology in terms of input (e.g., Mohr, 1971; Overton, Schneck & Hazlett, 1977) or output characteristics (e.g., Freeman, 1973; Reimann, 1977) as well. Weiland and Ullrich (1976) have argued that emphasis on the conversion process to the neglect of input and output activities reflects the continuing influence of early versions of scientific management of our contemporary conceptualization of organizations. Studies of technology that assess conversion process characteristics in isolation from the influence of input or output activities reflect a static, closed-system view of technology. Restriction of technology operationalizations to the conversion process has hampered understanding of the interrelations among technology characteristics. Moreover, research that is limited to one phase of an organization's technology fails to examine aspects of technology that may be particularly important to organizational effectiveness such as the compatibility of conversion processes with inputs.

The great majority of past organizational studies of technology have investigated the relationships between technology and organization structure. A major purpose of these studies has been to determine whether any prescription can be made regarding the most appropriate structure for an organization or department given its physical and informative technology (e.g., Hickson, Pugh, & Pheysey, 1969; Inkson, Hickson, & Pugh, 1970). However, most studies lack one ingredient essential to evaluation of the "appropriate" match between technology and structure: assessment of the organization's effectiveness.

Few studies of the technology-structure relation involve any assessment of effectiveness criteria (e.g., Woodward, 1958, 1965; Zwerman, 1970). Without some criteria of organizational effectiveness for reference, it is difficult to make any prescription regarding the appropriateness of a structure for a given technology. Thus, research on the technology-structure relation does

not generally lend itself to such prescriptions. Yet technology, as the process of transforming input into output, may directly affect the end states the organization achieves and thus the organization's effectiveness.

### Organizational Effectiveness

One reason for the omission of organizational effectiveness from consideration by researchers studying technology may be the difficulty of determining what organizational effectiveness means. In research on organizational effectiveness, most studies provide only operational definitions of the construct (e.g., expert ratings, profit, growth). Researchers seldom provide a theoretical definition of effectiveness. Moreover, those researchers who do provide a definition generally advance only one perspective: the natural systems model or the goal model. According to the natural systems model, organizational effectiveness is the organization's ability to maintain systemic integrity within its environment, including the capacity to acquire scarce and valued resources. Access to inputs and other resources are among the primary criteria of effectiveness in the natural systems model (Cameron, 1978). The goal model, on the other hand, holds that organizational effectiveness is the accomplishment of desired end states or goals (Price, 1968). However, Kirchoff (1977) has argued that the natural systems approach is but one aspect of the goal model since increasing inputs is an organizational goal. Indeed, goals may be defined broadly enough to include almost any criterion a manager or researcher may choose to measure.

The major issue in assessing organizational effectiveness is "effectiveness at what?" The natural systems model represents one facet of the organization's adaptation to the environment while the goal model clearly reflects the problem of goal achievement. However, neither model explicitly addresses other critical problems. Since organizational effectiveness represents how well the organization solves several critical problems, it includes but is not restricted to the concerns of the natural systems and goal models. In past research, most operationalizations of effectiveness are derived from the goal model (Rousseau & Ford, 1979). However, it is likely that effectiveness in solving various other organizational problems aid in goal achievement. One might expect that organizations adapting to their environments, or coordinating internal activities, can achieve certain goals. However, the concept of goal achievement is in danger of becoming a catch-all when goals are defined broadly enough to include any criterion a researcher might employ. To keep the notion of goal achievement a useful one, it is desirable to restrict its use to specific output-related end states (e.g., quantity, quality, costs, etc.). In evaluating the relation between technology and organizational effectiveness, technology may be most directly related to effectiveness criteria reflecting specific output goals since technology is a means for converting input into output. To initiate investigation of the technology-effectiveness relationship, criteria of goal achievement are used here.

### Technology and Effectiveness: The Issue of Appropriateness

Because technology in organizations is a means for processing inputs, one way it may influence the output goals achieved is through the extent to which inputs are compatible with the conversion process employed. The conversion process is interdependent with both input and output activities.

According to Thompson (1967), all three activities must be appropriately geared to one another for the organization to be effective: acquired inputs must be within the scope of capacities of the conversion process, and the organization must have the capacity to dispose of its products or services. Thus, the relation between input and conversion process characteristics may be expected to vary in organizations differing in effectiveness.

Matching inputs to conversion characteristics (and vice versa) reflects one emphasis of "appropriate" technology (Dickson, 1974). Although widely viewed as an argument for using more labor-intensive methods in production, or energy-conserving methods, appropriate technology more generally refers to the fit between technology and environment where the technology employed is compatible with the environment's needs and constraints. The concept of appropriate technology stems from a recognition of the link between technology and the environment. An appropriate technology is one that maximizes the effectiveness of the organization or work unit within a given environment. In organizations, characteristics of the input derived from the environment (such as the heterogeneity of raw materials or the unpredictability of emergency room admissions) are key environmental constraints. Compatibility between input and conversion processes is one dimension of appropriate technology. To assess compatibility, both input and conversion characteristics must be measured. However, an appropriate technology is difficult to determine a priori. Relations among input and conversion processes must be evaluated with respect to some criteria of effectiveness. Goal achievement, the extent to which the organization attains certain desired end states, represents one aspect of effectiveness particularly important to evaluating the role of technology in organizations. Goal achievement is important because technology is likely to be directly related to organizational outcomes through the output it produces. In the present study, the relation of technological characteristics to specific goals or end states is examined.

## METHOD

### Organizations

Archival data are employed in this study to obtain a large and diverse sample of organizations. All organizations in this study are general hospitals, providing technological diversity while controlling for organizational type.

Data were obtained for 203 short-term, non-Federal, general hospitals in the United States. Short-term, non-Federal, general hospitals are defined as hospitals with an average length of stay of less than 30 days and at least two departments or services (obstetrics and newborn count as one department). This definition excludes children's psychiatric, rehabilitation, geriatric, armed forces, and veterans' administration hospitals. Hospital size ranged from 21 to 1,062 beds, with a median of 148 beds.

These hospitals participate in the Professional Activity Study (PAS), a major program of the Commission on Professional and Hospital Activities (CPHA). Hospitals in PAS employ CPHA to process patient data. These data may then be used by the hospitals to meet government reporting requirements, and to obtain comparative information on their performance relative to that of other hospitals, as well as for other functions. PAS member hospitals account

for approximately 40 percent of all discharges from short-term, non-Federal, general hospitals in the United States.

The 203 hospitals in this study were drawn by a stratified random procedure from the base population of about 2,000 hospitals participating in PAS. Stratification was based on the following factors:

1. Number of patients in four size categories: under 4,000; 4,000-7,999; 8,000-11,999; and 12,000 or more patients annually.
2. Teaching status: defined as having at least one approved residency in internal medicine, obstetrics-gynecology, pediatrics, or surgery according to the 1975 American Medical Association Directory of Approved Residencies.
3. Census region: Northeastern, North Central, Southern, and Western.

#### Data Sources

Data were obtained from three sources: the 1976 Master Facilities Inventory (MFI), patient abstract records, and data from the Length of Stay Study (LOSS) conducted by CPHA.

The MFI is a micro-data tape derived from the Master Facility Inventory Survey conducted by the National Center for Health Statistics in conjunction with the Hospital Survey of the American Hospital Association. It lists every known inpatient facility and includes detailed information on hospital characteristics.

Patient abstracts are submitted monthly to CPHA from each hospital participating in PAS. In this study, patient data aggregated to the hospital level were obtained for all patients (excluding newborn and stillborn) discharged between January 1 and March 31, 1977; a total of 406,705 patients.

CPHA's Length of Stay Study data were used to assign an average expected length of stay to each hospital in the study. In the LOSS, mean length of stay was computed for all 1976 PAS hospital patients (a total of approximately 14 million discharges) in each U.S. Census region according to their primary diagnosis, age group, sex, and whether the patient was operated on or not (a total of 6,980 cell means). This score reflects the average length of stay, given region, primary diagnosis, operation status, and patient demographic characteristics. It can be used as a measure of the average length of stay expected given information on the patient and location of the hospital. The purpose of LOSS was to identify hospitals where patients had higher than expected lengths of stay and the factors contributing to higher than average lengths of stay. Patients were excluded when date of admission or discharge was missing or when discharge status was missing. Also excluded were those patients who transferred, died, or stayed in the hospital for more than 100 days.

Each patient in the present study was assigned an expected length of stay score based on the appropriate cell mean (where cells reflect the primary diagnosis, age, sex, and operation status of that patient and hospital census region). All patient expected length of stay values are averaged at the hospital level to produce an average expected length of stay for that hospital. This value reflects the average expected length of stay for a similar mix of patient types in that census region. This index represents the severity of diagnosis since more severely ill patients are expected to stay in the hospital longer. It can be compared with actual length of stay to indicate whether the patients are staying in the hospital longer than the severity of illness appears to warrant.

### Measures of Technology

Conversion characteristics. Broadly defined, the conversion process reflects the combination of skills, equipment, and procedures employed to transform or add value to some throughput (client or material). The conversion characteristics used here reflect the services and practices that may be employed in treating patients. This study uses seven measures of conversion characteristics:

Capital intensivity--the extent to which units in the hospital rely on machines rather than human effort and skills to do the work of the unit. Two physicians with experience in hospital research and administration rated a group of 20 facilities and services listed in the MFI (e.g., cardiac intensive care, burn unit, neonatal care unit) in terms of the extent to which work in these units is automated. A one to five scale was used ("1" where virtually all work is performed by people with little use of machines; "5" where virtually all work is performed by machines with little assistance from people). A capital-intensive score was assigned to each facility or service according to the average rating given it by the two raters. For each hospital, these ratings were assigned to its facilities and services. All such scores were then averaged for each hospital, producing an overall capital-intensive score for the hospital.

Diversity of units--number of special facilities and services the hospital offers, obtained from MFI list of facilities and services.

Multi-channel chemistry--the percentage of patients for whom multiple blood chemistry tests were performed by an automated multi-channel analyzer, based on patient records. This value was used to measure the level of mechanization in routine tests.

Operations--the percentage of patients discharged who were operated upon, based on patient records.

Staffing--based on MFI data, the researchers computed the proportions of total full-time equivalent staff listed as physicians, residents, and registered nurses, using two part-time staff to equal one full-time staff member.

Input characteristics. Input characteristics describe the nature of the materials or clients the organization processes. They are characteristics of the technology because the conversion process requires them and must respond to them to produce output. In the present study, input characteristics reflect attributes of patients which may influence and constrain the conversion process. Seven variables were examined as input characteristics:

Average age--the mean age of all patients discharged from the hospital, based on patient records.

Male--the percentage of discharged patients who were male, based on patient records, included because the sexes differ in terms of diagnoses and required services.

White--the percentage of discharged patients who were white, based on patient records, included because racial groups differ in diagnoses and required services.

Emergency--the proportion of patients entering the hospital as emergency cases, a measure of the urgency of demand for hospital services, obtained from patient records.

Medicaid--the percentage of patients whose expected source of payment was Medicaid, based on patients records; this variable is a measure of patient socio-economic status.

Length of stay expected--LOS expected is a measure of the severity of the patient's diagnosis and was obtained from the Length of Stay Study described above.

Patient type--the number of different diagnostic groups recorded. CPHA classifies each patient into one of 47 diagnostic groups according to final diagnosis. The total number of different diagnostic groups indicates the heterogeneity of patients served by a hospital.

#### Organizational Effectiveness Indicators

In this study organizational effectiveness is operationalized as the end states or output goals the organization achieves. Since a hospital's direct product is the services provided to patients, outcomes experienced by patients reflect end states the organization achieves. Hence, this study assesses goal achievement effectiveness in terms of patient outcomes at the time patients are discharged. Note that death and transfer are forms of discharge. These outcomes are aggregated to the hospital level and include six measures:

Death rate--the percentage of patients who died between January and March 1977 in each hospital, based on patient records.

Length of stay observed--LOS observed is the average length of patient stay in each hospital, obtained from patient records. This value excludes patients who died, patients whose age or discharge status was not recorded, patients whose date of admission or discharge was

misrecorded, patients who were transferred to other hospitals, and patients who stayed 100 days or more (thus excluding the chronically ill).

Inefficiency--the ratio of LOS observed to LOS expected. A high ratio indicates that patients tend to stay in the hospital longer than might be expected given the severity of their diagnoses and other contextual factors.

Left against medical advice--the percentage of patients, as indicated patient records, who left the hospital against the advice of their physician(s). It is expected that an effective hospital will have a low rate of leaving against advice.

Hospital transfers--the proportion of patients transferred to another hospital based on patient records. Hospital transfers may be viewed in at least two ways: as a loss of business on the part of hospitals that do not have sufficient or appropriate facilities to care for patients admitted, or as a means of concentrating services on those patients the hospital is able to treat best. It is included as a measure of strategic choice in dealing with inputs.

Occupancy rate--based on patient records, occupancy rate is the average daily census in the hospital, relative to number of beds, during the three months for which patient data were obtained. Occupancy rate is perhaps the most commonly used measure of hospital effectiveness (Rushing, 1964). Researchers and administrators consider it important since empty beds represent costs that are not offset by services and receipts.

#### ANALYSIS

The analyses presented here explore the relationships among technological characteristics and effectiveness criteria, among technological characteristics and effectiveness criteria when the influence of size is partialled out, and between input and conversion characteristics for organizations differing in effectiveness.

The unit of analysis in this study is the hospital. Zero-order correlations were computed among the measures of technology and organizational effectiveness. Since organizational size is known to have pervasive effects in hospitals (Berry, 1967), the relations between technology and effectiveness were also explored through correlations partialling out the influence of size. In addition, to examine the contribution of technology to the prediction of effectiveness unconfounded by hospital size, the effect of size on technological characteristics was removed by regressing size on the technological characteristics. Technology residuals (i.e. with the effect of size removed) were used in subsequent analyses to examine the relation of technology to effectiveness and the relation among technological characteristics without the corresponding confounding effects of size. The overall contribution of technological characteristics to the prediction of effectiveness was assessed using multiple regression of the effectiveness criteria against the sets of input and conversion characteristic residuals.

This study also explored the possibility of different relationships between input and conversion characteristics for hospitals differing in effectiveness. Such an analysis requires the use of an effectiveness criterion as a moderator variable. In this study, a subgroup comparison was used where high and low effectiveness groups are formed by dividing the sample at the median. Since effectiveness criteria are expected to correlate with both input and conversion characteristics, the statistics describing the relations between input and conversion characteristics in the subgroup analysis must be relatively unaffected by the correlations between the moderator and other variables of interest. Tukey (1954) recommends that unstandardized regression coefficients be compared in such cases since the slope is far less affected by range restriction than is the correlation coefficient. The present study reports both the slope (where each conversion characteristic is regressed against each input characteristic) and the correlation coefficient. This slope reflects the degree of change in the input characteristics associated with a unit (one standard deviation) change in the conversion characteristic. To focus on technological characteristics of hospitals, this analysis employed the input and conversion characteristic residuals, with size partialled out. Although several effectiveness criteria were measured in this study, the results for only one subgroup analysis are reported to illustrate the possible differential relationships between input and conversion characteristics for hospitals differing in effectiveness. Inefficiency was chosen because, in the present data, it has high intercorrelations with other effectiveness criteria and may be the criterion with the greatest relevance to organizations other than hospitals.

## RESULTS

### Technological Characteristics and Effectiveness Criteria

The zero-order correlations in Table 1 describe the relations among the technological characteristics and effectiveness criteria. Results indicate that input characteristics are weakly intercorrelated. However, conversion characteristics are more highly interrelated, with only multi-channel chemistry failing to correlate significantly with other conversion characteristics. The correlations indicate that capital-intensive hospitals operate on a higher percentage of the patients they discharge, and have a higher percentage of physicians and residents but fewer registered nurses than do labor-intensive hospitals. As might be expected, patients are more likely to be operated upon in hospitals having a high percentage of physicians and residents and less likely to be operated upon in those hospitals with a high percentage of registered nurses. Hospitals with a high percentage of physicians have greater proportions of staff who are residents and smaller proportions of staff who are registered nurses. Similarly, hospitals with a high percentage of residents have a relatively smaller proportion of nurses. These correlations indicate that conversion characteristics are more highly interrelated than are input characteristics.

Correlations between input and conversion characteristics, reported in Table 1, reveal that the input characteristics expected length of stay and number of patient groups have the highest correlations with conversion characteristics. Expected LOS, a measure of severity, and number of patient groups, a measure of patient diversity, are each higher in capital-intensive hospitals, in hospitals doing more operations, and in hospitals with a high

Table 1  
Intercorrelations of Technological Characteristics, Size, and Effectiveness  
N=203 hospitals

	1	2	3	4	5	6	7	8	9	10	11	12	13
<u>Input Characteristics</u>													
1. Average age													
2. % Male	.07												
3. % White	.18*	.07											
4. % Emergency	.28**	-.25**	.03										
5. % Medical	-.16	-.38**	.08	.05									
6. LOS expected	.55**	.03	.13	.35**	-.10								
7. Patient types	-.59**	-.10	-.17	-.22*	.05	.02							
<u>Conversion Characteristics</u>													
8. Multi-channel chemistry	.36**	-.01	.03	.06	.02	.34**	-.08						
9. Capital intensity	-.23**	-.04	.19*	.03	-.13	.21*	.47**	-.05					
10. % Operations	.04	-.17	-.03	.16	-.17	.22*	.37**	.03	.62**				
11. % Physicians	.00	-.27**	-.02	.21*	.10	.18	.10**	-.09	.35**	.49**			
12. % Residents	-.03	-.29**	-.08	.21*	.07	.26**	.30**	-.05	.40**	.36**	.45**		
13. % Registered nurses	.14	.21*	.10	-.25**	-.21*	-.37**	-.48**	-.07	-.40**	-.47**	-.38**	-.38**	
14. Diversity of units	-.11	.02	-.11	.02	-.01	.30**	.61**	.00	.40**	.55**	.25**	.34**	-.74**

Table 1 con't.

	1	2	3	4	5	6	7	8	9	10	11	12	13
<u>Organizational Effectiveness</u>													
15. % Hospital transfers	.20**	.06	.11	.01	-.08	-.17*	-.50**	-.16*	-.33**	-.56**	-.27**	-.29**	.44**
16. % Against medical advice	.17*	.16*	-.13	.13	.25**	.15*	-.23**	.19*	-.19*	-.02	.08	.10	-.01
17. LOS observed	.36**	-.14	.00	.42**	-.03	.83**	.13	.32**	.24**	.27**	.22*	.39**	-.50**
18. Inefficiency	-.08	-.30**	-.19*	.29**	.08	.16	.21*	.10	.14	.18*	.16	.36**	-.40**
19. % Deaths	.55**	-.07	.00	.36**	-.05	.50**	-.39**	.29**	-.19*	-.17	-.02	.14	.02
20. % Occupancy rate	-.20**	-.08	-.08	.07	-.02	.32**	.67**	.11	.38**	.52**	.31**	.41**	-.83**
21. Size	-.17	-.10	-.07	.06	-.06	.36**	.55**	.12	.33**	.48**	.27**	.40**	-.72**

Table 1 con't

	14	15	16	17	18	19	20	21
<u>Organizational Effectiveness</u>								
15. % Hospital transfers	-.50**							
16. % Against medical advice	-.04	-.03						
17. Los observed	.46**	-.29**	.27**					
18. Inefficiency	.38**	-.25**	.24**	.68**				
19. % Deaths	.00	.13	.01	.51**	.23**			
20. % Occupancy rate	.81**	-.50**	.00	.56**	.47**	.00		
21. Size	.81**	-.43**	.00	.53**	.44**	.00	.55**	

\*p&lt;.05

\*\*p&lt;.01

percentage of physicians and residents. Both of these input characteristics are, however, negatively related to the percentage of registered nurses. Further, hospitals with a high expected LOS report more use of multi-channel chemistry than those with low expected LOS.

Effectiveness criteria demonstrate the dissimilar pattern of intercorrelations found by earlier researchers (Seashore, Indik, & Georgopoulos, 1960). Hospital transfers are negatively related to leaving against medical advice, observed LOS, and occupancy rate, indicating that a hospital that transfers its patients to other hospitals has fewer patients leaving against medical advice, lower LOS, and a lower occupancy rate--findings that are not too surprising since hospitals may be eliminating the patients they find most difficult to serve or may be better able to treat those they do not transfer. These findings suggest that the transfer of certain types of patients may improve hospital effectiveness as measured in this study. Hospitals with high percentages of patients leaving against medical advice have a high LOS observed and a high rate of inefficiency, which may indicate that patients leave against medical advice after they have been in hospitals where they or other people have stayed an unduly long time. However, inferences about patient behavior from data aggregated to the hospital level are highly questionable given the risk of ecological correlation error (Roberts, Hulin, & Rousseau, 1978; Robinson, 1950). In the present analysis, we may conclude that the rate of patients leaving against medical advice, a measure of patient satisfaction with care, is related to other criteria of hospital effectiveness.

Not surprisingly, hospitals with a high average LOS are also more likely to have high inefficiency and death rates as well as a high occupancy rate than are hospitals with a low average LOS. Aside from its relation to LOS, inefficiency is also highly related to both death rate and occupancy rate. Death rates are highest in hospitals with high LOS observed and high inefficiency rates. Occupancy rate, a frequently used criterion of effectiveness in hospital research (Rushing, 1974), is associated with low hospital transfers and high LOS observed. Thus, these results suggest that criteria of hospital effectiveness are highly interrelated.

Turning to the relation of input and conversion characteristics to organizational effectiveness, Table 1 indicates that both input and conversion characteristics have substantial relations to effectiveness. The input characteristics expected LOS, number of patient groups, and average age are highly related to the effectiveness criteria, particularly to LOS observed and death and occupancy rates.

All of the conversion characteristics are significantly related to several effectiveness measures. Hospitals using a high degree of multi-channel chemistry have lower rates of transfers, higher rates of death and leaving against medical advice, and higher LOS observed than those who use multi-channel chemistry less often. Capital-intensive hospitals have a higher LOS observed and a higher occupancy rate than labor-intensive ones, but they have fewer transfers, fewer patients leaving against medical advice, and fewer deaths. Hospitals with a high percentage of physicians or residents have fewer transfers, higher LOS observed, and a high occupancy rate. Further, hospitals with a high percentage of residents also have higher inefficiency scores than those with fewer residents. Hospitals with a high percentage of

registered nurses have more patient transfers, lower LOS observed, lower inefficiency rates, and lower occupancy rates.

#### Controlling for the Effect of Size

The results described above are derived from analysis performed on hospitals of diverse size. Rushing (1974) has pointed out that size has a great influence on hospital characteristics and on effectiveness. The present analysis indicates that size is particularly highly related to conversion characteristics, with significant correlations with each measured conversion characteristic except multi-channel chemistry. Results indicate that larger hospitals are more capital intensive and have greater percentages of operations, physicians, and residents but smaller percentages of nurses than do smaller hospitals. Size is also significantly and positively related to two input characteristics, LOS expected and number of patients types. However, size is less highly related to input characteristics than to conversion characteristics. Additionally, it contributes substantially to the prediction of hospital effectiveness, with larger hospitals having a higher LOS observed, greater inefficiency rates, and higher occupancy rates than smaller ones, but with fewer hospital transfers. Since in the present study size is highly related to both conversion characteristics and effectiveness, additional correlations were computed among technological characteristics and effectiveness with the effect of size removed (Table 2). The purpose of the latter analysis is to investigate the relation of technology to effectiveness without the confounding influence of size.

Because of the low relation between input characteristics and size, the correlations in Table 2 demonstrate a similar pattern of intercorrelations among input characteristics as discussed above for Table 1. Similar results are also found for the conversion characteristic intercorrelations. However, there is generally a considerable reduction in the magnitude of these intercorrelations when the influence of size is removed.

The relations among the effectiveness criteria are greatly affected when size is controlled. With size partialled out, hospital transfers correlate only with occupancy rate. Leaving against medical advice correlates only with LOS observed. However, the relation of LOS observed and inefficiency to other criteria are largely unaffected by partialling out size. Each continues to be significantly and positively related to death rate and occupancy rate as well as to each other.

Intercorrelations between input characteristics and conversion characteristics demonstrate substantial changes when size is partialled out, particularly for those involving LOS expected and the proportion of males admitted. Similarly, relations between technological characteristics and effectiveness measures tend to drop in magnitude and significance when the influence of size is removed. Correlations between technological characteristics and inefficiency rate are particularly affected, with the greatest reduction in the number of significant relations.

In a few cases, partialing out size altered the direction of the relationship (e.g., the relations of white with emergency and medicaid, patient groups with LOS expected, LOS expected with patient groups and multi-channel

Table 2  
Intercorrelations Holding Size Constant  
N=203 Hospitals

	1	2	3	4	5	6	7	8	9	10	11	12	13
<u>Input Characteristics</u>													
1. Average age													
2. % Male	.19*												
3. % White	.00	.02											
4. % Emergency	.30**	.04	-.23**										
5. % Medicaid	-.16	.04	-.36**	.06									
6. LOS expected	.62**	.21*	.06	.32**	-.07								
7. Patient types	-.59**	.11	.01	-.34**	.06	-.22*							
<u>Conversion Characteristics</u>													
8. Multi-channel chemistry	.33**	.03	.00	.04	.07	-.33**	-.14						
9. Capital intensity	-.14	.14	.03	.00	-.14	-.01	.23**	-.03					
10. % Operations	.07	.04	-.06	.11	-.09	.05	.23**	.01	.33**				
11. % Physicians	.07	-.04	-.14	.18*	.11	.11	.15	-.04	.15	.37**			
12. % Residents	.02	-.02	-.13	.17	.12	.05	.09	-.06	.21**	.22**	.26**		
13. % Registered nurses	.04	.00	.13	-.22*	-.34**	-.16	-.20*	.00	-.17	-.23**	-.27**	-.12	
14. Diversity of units	.01	-.05	-.15	.12	.12	.07	-.07	-.12	.07	.12	.32**	.21**	-.15

Table 2 cont'd.

	1	2	3	4	5	6	7	8	9	10	11	12	13
<u>Organizational Effectiveness</u>													
15. % Hospital transfers	.16	.06	.08	.11	-.13	-.05	-.41**	-.15	-.40**	.40**	-.26**	-.20*	.20*
16. % Against medical advice	.15	.09	-.04	.19*	.30**	.14	-.24**	.14	-.31**	-.12	.05	.06	-.6*
17. LOS observed	.48**	.10	-.03	.42**	.04	.79**	-.20*	-.08	-.09	.03	.10	.19*	-.18*
18. Inefficiency	-.03	-.12	-.14	.26**	.17	-.02	-.02	.34**	-.13	-.01	.02	.26**	-.08
19. % Deaths	.58**	.02	-.06	.35**	-.07	.50**	-.45**	.10	-.18	-.20*	.01	.14	.02
20. % Occupancy Rate	-.30**	-.08	-.02	.02	.00	.04	.46**	-.03	.40**	.31**	.33**	.28**	-.42**

Table 2 con't.

	14	15	16	17	18	19	20
<u>Organizational Effectiveness</u>							
15. % Hospital transfers	.15						
16. % Against medical advice	.12	.00					
17. LOS observed	.11	-.08	.21**				
18. Inefficiency	.27**	-.08	.17	.57**			
19. % Deaths	.03	.16	.09	.56**	.22**		
20. % Occupancy rate	.10	-.30**	-.06	.21**	.26**	-.12	

\*p < .05

\*\*p < .01

chemistry, operations with hospital transfers, and patient groups with LOS observed). These results confirm previous findings of the pervasive effect of size in hospitals. Yet, generally the results argue that the magnitude of the relations among technological characteristics and effectiveness criteria is more influenced by the effect of size than is the direction. In all analyses discussed in the following pages, the relation of size to technological characteristics is partialled out. Thus, inferences can be made on the relation of technology to effectiveness without the confounding influence of size.

To examine the relative contribution of input and conversion characteristics to the prediction of effectiveness, multiple correlations were run between the sets of input and conversion characteristics and the effectiveness criteria (Table 3). In general, results suggest that input characteristics have a pervasive impact on the end states achieved. When comparing the unique contribution of input and conversion characteristics to the prediction of effectiveness criteria, results indicate that, with the exception of occupancy rate and hospital transfers, each criterion is better predicted by input characteristics. Conversion characteristics appear to predict the rate of hospital transfers better than do input characteristics, possibly because transfers are affected by the hospital's capacity, as reflected in conversion characteristics. In the case of occupancy rate, neither input nor conversion characteristics significantly predicted this effectiveness criterion.

Examination of the squared multiple correlations in Table 3 suggest that input characteristics are more important than the conversion characteristics to the prediction of end states achieved. Such a finding is reasonable particularly in service organizations where the end states produced represent attributes or responses of clients or patients. In such instances, it is necessary to look beyond characteristics of the organizations or work systems per se to identify factors affecting the ends or goals the organization achieves. Input characteristics reflect both something about the organization (the resources or demands it processes) and something about the environment (the constraints imposed on the organization). The salience of input characteristics as predictors of effectiveness criteria in the present study argues for assessments of technology in organizations that go beyond conversion characteristics when we seek to evaluate the relationship between technology and effectiveness.

#### The Fit between Input and Conversion Characteristics

So far, we have considered the role of input and conversion characteristics as main effects that are directly related to the end states the organization achieves. However, since input and conversion characteristics are intercorrelated, different patterns of input and conversion characteristics may exist for organizations differing in effectiveness. To explore this possibility, a subgroup analysis was performed (Table 4) using the effectiveness criterion of inefficiency as a moderator variable. Two groups were created by dividing the sample at the median. Results of this analysis produced little evidence of an interaction between input and conversion characteristics for organizations differing in effectiveness. Subgroup analyses on the other effectiveness criteria also produced generally non-significant differences between effective and ineffective hospitals. T-tests

Table 3  
Proportion of Variance in Effectiveness Criteria Accounted  
for by Technological Characteristics<sup>1</sup>

	LOS Observed	Ineffi- ciency	Death	Occupancy Rate	Hospital Transfers	Against Medical Advice
Input characteristics <sup>2</sup>	.49*	.13*	.41*	.06	.15*	.18*
Conversion characteristics	.19*	.10*	.15*	.06	.21*	.13*
Input and conversion characteristics	.51*	.16*	.48*	.06	.30*	.29*
Proportion of variance explained by input characteristics inde- pendent of conversion	.32	.06	.33	.00	.09	.16
Proportion of variance explained by conversion characteristics inde- pendent of input	.02	.03	.07	.00	.15	.11

<sup>1</sup> Technological characteristics represent residuals after effect of size has been partialled out.

<sup>2</sup> Input, conversion, and input and conversion values represent squared multiple correlations.

\*  $p < .05$

Table 4  
Relationship between Input and Conversion Characteristics for Hospitals Differing in Inefficiency

		MLTZ	Capital Intensive	Operations	Physicians	Residents	Registered Nurses	Diversity of Units
Age	Low	.01* (.22*) <sup>2</sup>	-.10 (-.17)	-.02 (-.04)	.00 (-.12)	-.01 (-.01)	.00 (-.07)	-.04 (-.05)
	High	.02* (.43*)	-.02 (-.01)	.00 (-.00)	.00 (-.08)	.00 (-.05)	.00 (-.05)	.04 (-.07)
Male	Low	-.23 (-.08)	12.58 (.16)	.14 (-.11)	.01 (-.00)	.00 (-.00)	-.02 (-.03)	11.20 (-.20)
	High	<u>1.18* (-.43*)</u>	-4.59 (-.07)	-.56 (-.19)	-.80 (-.16)	-.71 (-.14)	-.02 (-.03)	5.81 (-.09)
White	Low	-.12 (-.07)	.71 (-.01)	-.06 (-.05)	<u>.19 (-.09)</u>	.04 (-.07)	-.02 (-.05)	-5.51 (-.16)
	High	.07 (-.07)	.89 (-.07)	-.07 (-.19)	<u>-.47* (-.41*)</u>	-.10 (-.13)	.02 (-.00)	.15 (-.00)
Emergency	Low	-.06 (-.07)	-2.44 (-.25)	.00 (-.03)	-.05 (-.11)	-.05 (-.08)	-.01 (-.02)	-1.50 (-.08)
	High	.26 (-.24*)	1.42 (-.08)	.00 (-.00)	.17 (-.15)	.17 (-.19)	-.08 (-.13)	-1.60 (-.07)
Medicaid	Low	.33 (-.06)	-8.71 (-.07)	-.03 (-.00)	.46 (-.09)	.19 (-.02)	.14 (-.09)	-3.64 (-.05)
	High	.16 (-.06)	-3.89 (-.05)	-.05 (-.05)	.27 (-.06)	.31 (-.16)	<u>-.56* (-.39*)</u>	-3.18 (-.00)
LOS expected	Low	.01* (-.31*)	-.07 (-.12)	.00 (-.08)	.00 (-.08)	.00 (-.00)	.00 (-.00)	-.06 (-.08)
	High	.01* (-.46*)	-.05 (-.20*)	.00 (-.01)	.00 (-.20*)	.00 (-.06)	.00 (-.18)	-.05 (-.00)
Patient groups	Low	-.01 (-.16)	.21 (-.30*)	<u>-.01* (-.28*)</u>	.01 (-.14)	.00 (-.10)	.00 (-.28*)	.33* (-.32*)
	High	-.01 (-.13)	.42 (-.46*)	<u>.00 (-.16)</u>	.00 (-.03)	.00 (-.08)	.01* (-.29*)	.45* (-.29*)

\* p < .05

<sup>1</sup> Unstandardized regression coefficients of conversion characteristics regressed on input characteristics.

<sup>2</sup> Correlation coefficients.

Note that underlined coefficients indicate a significant difference (p < .05) between the unstandardized regression coefficients.

for differences between unstandardized regression coefficients (McNemar, 1965) were performed on all pairs of regression coefficients where at least one slope was significant. Only four pairs were significant ( $p < .05$ ), a rate very close to what would be expected by chance given the number of pairs of coefficients.

In summary, results indicate that both input and conversion characteristics are related to the effectiveness criteria. However, input characteristics appear to be more highly related to effectiveness criteria and to predict effectiveness criteria independent of their relationship with conversion characteristics. Finally, this study finds little evidence for differences in relations between input and conversion characteristics for organizations differing in effectiveness.

## DISCUSSION

This study indicates that technological characteristics are highly related to several output goals hospitals achieve. It suggests that research on the technology-efficiency connection may be fruitful for organizational scientists concerned with the role of technology in organizations and for those practitioners concerned with improving organizational effectiveness. In hospitals (Phillips, 1978) and in service organizations generally (Rossi, 1978), we see increasing interest in evaluating the contribution of client characteristics (inputs) and treatments (conversion processes) to organizational effectiveness. Currently, according to Rossi (1978) such evaluations are infrequent and difficult, partly due to deficiencies in the theories characterizing service organizations. Moreover, organizational research seldom explores the relation between technology and effectiveness. Nonetheless, the link between technology and effectiveness is an area in which the interest of scientists and practitioners intersect. Development of a meaningful description of technology and its "effects" may enhance our understanding of technology's role as an input-output mechanism and provide a basis for assessing the appropriateness of technologies given an organization's needs and constraints.

### A Model of Technology

Organizational scientists (Rousseau, 1979b; Scott, 1975) have argued that to study an organization's technology it is necessary to view it as a mechanism for transforming and adding value to an input. This view is compatible with both an open systems model (Katz & Kahn, 1978) and with the traditional model of work employed by industrial engineers (Hancock, Macy & Peterson, 1978). The basic phases of this process are input (where materials and information are brought into the work place), conversion (where value is added to the input through transformation, creation of new ideas, or other conversion activities), and output (where products, services, or information are provided to the environment). Additionally, both the input and output phases can be divided into two distinct components: characteristics and control functions. Characteristics of inputs are attributes of the materials, ideas, clients, or other inputs brought into the organization. Input control functions are mechanisms that buffer the conversion process from uncertainty and variability. Input control mechanisms influence the availability and distribution of inputs in preparation for conversion. Input

characteristics such as heterogeneity of inputs can be distinguished from input control functions such as stockpiling. In a similar manner, output has two aspects. Output characteristics are qualities of output following completion of the conversion process, such as the number of different products or services provided. Output control refers to mechanisms that influence output quality or quantity, such as quality control and stockpiling. Together, these five phases describe the conversion of input into output, which constitutes technology in organizations.

Virtually, all operationalizations of technology in organizational research are derived from one or more--usually one--of these phases. However, most research on technology focuses on conversion characteristics such as level of automation or routineness. Little empirical evidence exists regarding the intercorrelations among the phases of technology. The present study indicates that substantial relations exist between input characteristics and conversion characteristics, suggesting, that some degree of "fit" is present among organizations of relatively similar technologies. It also suggests that these phases are differentially related to effectiveness. However, the high relationship of input characteristics to effectiveness criteria demonstrated in this study may generalize only to hospitals or to other service organizations. Research is needed on the relationships among input characteristics, conversion characteristics, and effectiveness criteria in manufacturing organizations as well.

These observations highlight the necessity, in studies of organizational effectiveness, to take account of environmental conditions when examining the fit of an organization's technology to its organizational characteristics, as an explanation of goal attainment outcomes. A significant void in the present study is the absence of data representing the hospitals' control over the input mix of patients. One suspects that short-stay general hospitals, in a catchment area served also by specialized hospitals, are more likely than those lacking such complementary hospital services to receive patients who are in some way pre-selected for input uniformity. In such a situation, there is greater feasibility for adaptation of the hospital's organization and technology to a less diverse array of patient types. This issue of environmental adaptation has been explored in a study of hospital emergency services (Georgopoulos, Cooke & Associates, 1980).

In addition to the five phases described above, technology in organizations can be differentiated across levels. One can speak of a global technology characterizing an organization's technology, a unit technology describing department or subunit technology, and job-level technology delimiting the input-throughput-output processes at the individual level. Since input, conversion, and output activities occur at all levels of analysis, technology can be viewed as a multi-phasic, multi-level mechanism for converting input into output. The present study is restricted to the organization level. According to Scott (1972), organization-level analysis of hospital technology reflects an administrator's view of the medical task (ministering to the needs of a patient population) rather than a practitioner's view (ministering to the needs of individual patients). Obviously, both perspectives are pertinent to the technology-effectiveness relationship, but they require different levels of analysis.

The nature of the technological phases described above are likely to vary greatly across types of organizations. For example, human service organizations such as hospitals may require more elaborate input control mechanisms because of variability in client demands than do manufacturing organizations. Differences in input control mechanisms are probably directly related to the types of input processed. The need for output control functions are likely to be influenced by the predictability of the conversion processes as well as by environmental demands for product quality. All of these mechanisms may be interrelated in ways of interest to both organizational scientists and administrators. Specification of the phases of technology and their interrelations may be a first step toward developing a theory of technology that identifies those characteristics of service delivery systems and production units that are most salient to the end states the organization achieves.

### Effectiveness

The criteria of effectiveness evaluated in this study were limited to specific goals or end states the organization achieves. Those goals that were significantly related to the technological characteristics assessed here reflect characteristics of patients when discharged (aggregated to the organization level). The one criterion not generally related to technological characteristics, occupancy rate, reflects the use of hospital capacity rather than some state associated with patients. Results suggest that an organization's technology may directly affect the organization's output but not necessarily how well it uses its capacity. Although size correlated highly with technological characteristics and with several effectiveness criteria, results of this study suggest that the relationship between technological characteristics and effectiveness remains when the effect of size is controlled.

This study argues that an organization's technology is directly related to how well the organization solves one crucial problem: the achievement of specific output goals. The output goals held by specific hospital administrators were, however, not assessed. Rather, measures of goal achievement were derived from output information available to hospitals through the data management system they employ. Such goals are likely to be specific to the type of organization studied. Observed length of stay, for example, may have no close parallel in manufacturing organizations.

In service organizations, the end states achieved often are directly associated with the state of the client on leaving the organization--where the output (cured patient or educated child) is in essentially the same form as the input. Such is not the case in an oil refinery or an automobile assembly plant. Thus, we expect that differential relations may exist between input characteristics and the end states achieved in service and manufacturing organizations. The nature of inputs is nonetheless likely to affect other characteristics of the organization's technology to some degree regardless of organizational type.

### Limitations

As an exploration of the technology-effectiveness relationship, the present study is limited by its assessment of only two phases of technology and only one level of analysis. It is also restricted to one type of organization,

short-stay general hospitals. In addition, the criteria of effectiveness assessed here are aggregated from the individual to the organization level. Thus they can tell us something about rates of certain end states in hospitals with different technological characteristics but do not allow inferences at the individual level.

The types of technological characteristics measured in this study are also limited. Although we feel that the characteristics assessed here are important ones, the number of possible descriptions of technological characteristics is quite large. We must conclude that multivariate assessments of technology are necessary both within and across different phases of technology in organizations. Only when assessments of technology reflect its diverse phases will we begin to understand the nature of the workflow in organizations.

### Conclusion

This study echoes the concern of many organizational scientists regarding the meaning of the concepts of technology and effectiveness. It argues that greater attention to definition and measurement is needed in both areas. Both concepts are troublesome to organizational scientists. In research on technology, writers argue for clarity of definition and disaggregation of the concept (e.g., Stanfield, 1975). Difficulties in conceptualizing organizational effectiveness have led researchers to recommend everything from metaphor (Pondy, 1977) to abandonment of the concept (Hannan & Freeman, 1977).

One thing is clear. Research on technology and organizational effectiveness is at a juncture. Both concepts are central to organizational theory and research and both require different treatment than they have previously received. This study demonstrates that technological characteristics are related to effectiveness criteria in a way that argues against the traditional narrow, conversion-oriented assessments of technology. Further, it suggests that technology in organizations represents qualitatively different phases that should be assessed simultaneously if we are to understand the role of technology in organizations. The differential relations of these phases to criteria of organizational effectiveness are an important consideration in developing theories of organization. We believe that a good deal can be learned about the nature of both technology and effectiveness by studying them jointly.

The enlargement of the ideas included in this paper holds the promise of movement beyond the use of goal attainment measures as merely historical estimates of organizational effectiveness toward the use of related concepts and measures for improved estimation of future goal attainment. This possibility arises because an understanding of the compatibility of work system components (e.g. input control, organizational structure, technological resources, etc.) allows the assessment of probable organizational effectiveness under expected future conditions of changing environmental opportunities and constraints.

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